Business Is Getting Better

THE decks are being cleared and business is being prepared to go ahead full steam back to normal.

Every well informed observer of business trends and business recovery agrees that the time has arrived when the throttle may be pulled wide open and the new streamline business train can surge forward confidently.

All reports go to show that we have made a great clean-up preparatory to a big business revival. The brain trusters, the Frankfurter boys, the inflationist whoopers and the Wall Street tamers have served a very useful purpose. They have produced measures and formulated bills for administrative and congressional hearings and consideration, which have struck body blows at holders of special privileges, rut-bound standpatters and constitutional blockers.

We have been more amused than seriously impressed at the chorus piercing screams which arose from the aforesaid gentry as the parade of new legislation was exposed to the public. We cannot see wherein lies the menace to the public good in having put before Congress and the public any legislation which said group of brain trusters, or trust busters, think is worthy of consideration. This is a free country after all and one of the tenets of our freedom is the right which any citizen or group of citizens inherently possess and cherish—that of submitting new ideas and forms for remedial measures up to our law makers for investigation hearings and enactment.

We have never for a moment doubted the resident great common sense opinion of the sterling, rank and file, business and industrial mind, in this country. Despite all the hysteria which has been indulged in during the consideration of the Wirt investigation, the Stock Exchange bill and the Securities Act, when they come to be voted upon, Congress will react to the great majority business opinion prevailing in the land. That majority opinion is not for wrecking business, but for conserving and bettering business.

So, as we enter this month of May, it seems to us that Congress has had ample time to take the pulse of the country on all pending legislation liable to be enacted before adjournment. We believe that when these controversial measures finally are voted, they will come through greatly modified in many of the radical provisions which they originally carried.

It does no harm to look at and consider radical measures. We do need to learn that in this country there are many grades and shades of opinion which, while radically differing from our opinions, are nevertheless held by persons or groups none the less patriotic, than we are. The great safety valve is found in according these radical groups the privilege of expression and consideration.

If among their proposals are found ideas, panaceas and forward looking measures of benefit and in demand, and the consensus of opinion after due hearing sustains them, all well and good, enact them. Try them. If they are found wanting, they can speedily be changed,—if they do not lapse into innocuous desuetude in the meantime.

Thus, it is that as we survey the immediate future, we can find nothing to worry about unduly.

We believe business has had a handsome housecleaning. We believe we are on the verge of a material upturn in business.

It wouldn't surprise us at all to hear some day before long that some few particularly over-ardent brain trusters were separated from contact with the

administrative head of the nation; that certain activities of the A-B-C-D ..... departments of Government, who have erred economically and brought political embarrassment to the nation's leader, were summarily abolished—not at all! For we remember well the pledge of the President given to the people that while many of these measures were purely experimental, yet if they failed to work, they would be changed.

We still believe that the United States is thoroughly sound and that business is fundamentally better—getting better every day in every way and its magnificent recuperative powers are about to become nationally manifest.

Paper Mills Thirst for Good Water

MUCH has been written on the subject of water requirements for pulp and paper making. Water, throughout the centuries, has been the vehicle used to carry the minute fibers to their felting medium whether a handframe or the wet end of a paper machine. Without a suitable supply of good water Tsai Lun would probably have been unable to convert the inner bark of the paper mulberry tree into the first paper and there might even have been no beginning to the papermaking industry. Certainly our present industry could not get along without water.

Good water in sufficient abundance is a fundamental prerequisite to the successful operation of a pulp and paper plant. In fact, it is doubtful, except in exceptional cases, if there is any other factor of equal importance when considering the choice of location for a pulp and paper mill.

From the days of William Rittenhouse, who in 1690 built the first paper mill in this country, until now, those behind the development of the industry have been forced to seek an unfailing water supply of such quality and in such quantities as necessary to meet the process requirements of each individual establishment. Mills that might have been located unsatisfactorily from the standpoint of process water requirements are forced by necessity to function under a handicap with those mills more favorably located in so far as production activities are concerned.

Some one has stated that the water requirements of an average mill are greater than the requirements of an ordinary city. Such a statement, to be sure, is extremely general in character. Nevertheless, it might be said that estimates of several billion gallons of water daily have been suggested as being required to meet the needs of the pulp and paper mills of the United States.

Good natural supplies of water in tremendous volume are so commonplace to pulp and paper mill operators that it is doubted if many ever give thought to the marvel of it all. This fact was brought most forcefully to mind through a recent news item covering a paper entitled, "The Bermuda Water Works," which was presented by Dr. W. D. Turner of Columbia University before a joint meeting of several chemical organizations at the Chemists' Club in New York City. It was brought out in the item that until 1929 Bermuda had to depend entirely for fresh water on importations from New York or on rain water collected from roofs or specially constructed catchments. This was said to be necessary because no method had been found to collect underground fresh water without salt contamination from the sea water which permeated the coral structure of the islands. A system of horizontal wells or infiltration galleries for collecting surface waters, conceived by Dr. Turner, was found to produce water free from salt but very hard, due to percolation through the sandstone. This system, when supplemented by an extensive softening process, has made it possible to produce a soft, fresh, pure water which is being distributed throughout the colony in asbestos water mains designed to be resistant to the serious corrosion conditions existing in these subtropical sea islands.

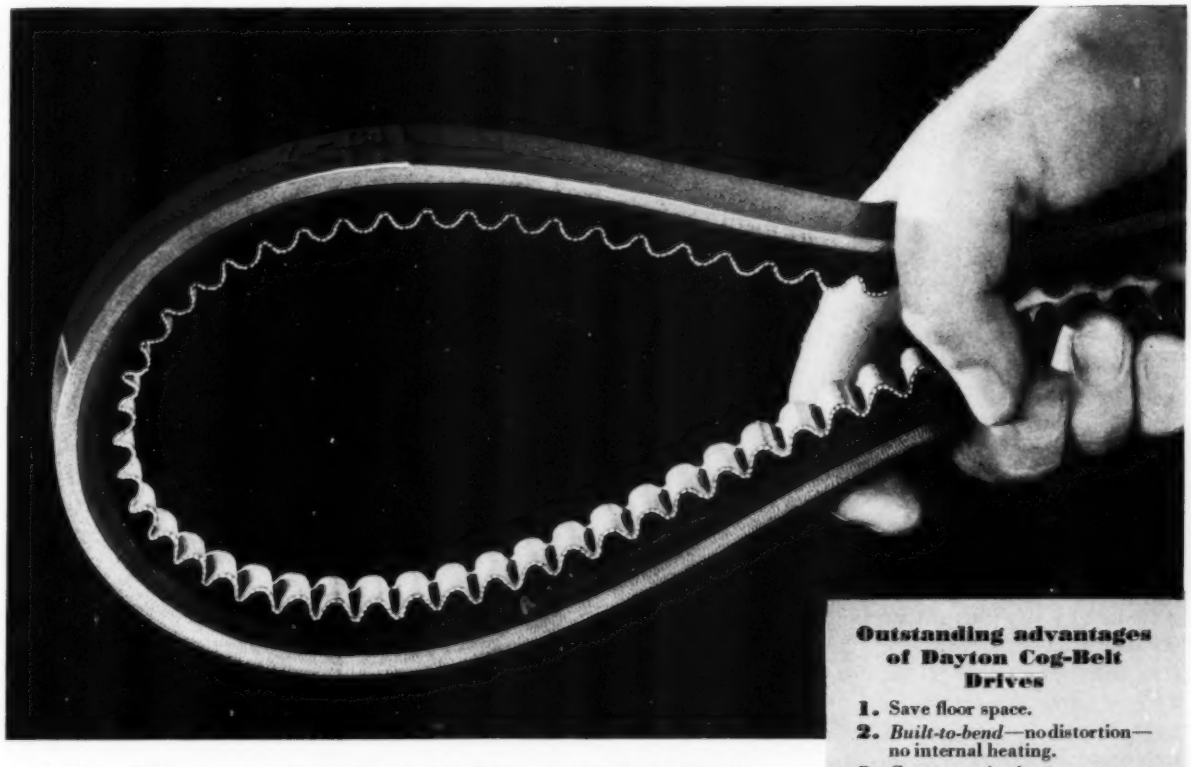
Such a system, to be sure, is a marvelous scientific and engineering achievement, and all of those who had anything to do in making it a reality are to be complimented. Yet, how much more marvelous are the natural water supplies of our pulp and paper plants. Should we not be more appreciative of them?

If You Want to Get Ahead

DISSATISFACTION is a powerful influence in constructive effort. Without it, there would probably be little to urge us on to greater accomplishment.

In fact, seldom is one found who has lost completely the desire for greater attainment; but many are they who have lost courage or are aimlessly drifting into the future without any goal in particular. For those who are striving to get out of life a little more than they have up to this time been able to secure is suggested the recent published work of Ray W. Sherman. Mr. Sherman in his book, *If You Want to Get Ahead*, records in a very practical way such principles of successful living as he has seen demonstrated over many years of business experience. Maybe some of his suggestions might prove helpful to you. Read it.

Built to bend



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And along with their greater efficiency, Dayton Cog-Belts *cost less to use.* Adjustments are seldom necessary, for the "stretch" is removed in the process of manufacture. And their longer life means *lower replacement costs*—often *less than half* that of ordinary belts.

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• • •

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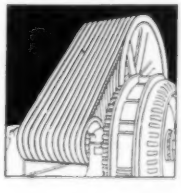

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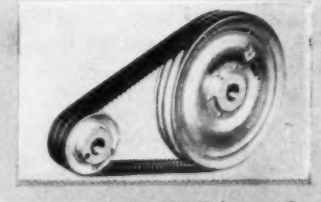

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The Job Ahead for Machinery

By WILLIAM SIBLEY

LAST month, on this page, I voiced the thought that contrary to prevalent superficial thinking the present and past high level of unemployment has been due, not to over-production but rather to under-consumption. Technological unemployment we have had—and will continue to have so long as there are improvements made to either machines or methods. But to place the blame for our past business depression or our high level of unemployment on our inability to keep up with our mechanical production facilities is not only to pursue a costly fallacy but stymie the very thing upon which American progress and prosperity is founded—our productive capacity.

Since writing my editorial last month there has been brought to my attention a remarkably trenchant little essay on this very subject, written and published by the Farrel-Birmingham Company, Inc., Number Eleven Main Street, Ansonia, Connecticut. This little pamphlet is entitled *The Job Ahead for Machinery* and is so crammed full of irrefutable facts that I suggest you write for a copy. I do not know that there is any cost involved. Without previous assurance from them, I still feel confident they would be glad to send a copy of their booklet gratis. But whether or not they would, this publication is worth a dollar—and serious study—by every executive in the paper and pulp industry.

Whether we like to admit it or not, the present administration is doing everything in its power to upset the nation's production apple-cart. Agitation for the 30-hour week, various industrial codes, and class legislation of varying kinds are being pushed through—all to the end that machinery improvements or scientific developments must be prohibited, or limited by license, for a period of years. *The Job Ahead for Machinery*, accepting these dictums from Washington as its premise, shows clearly and concisely that not only do machinery and productive mechanics fail to create permanent unemployment, but on the contrary there can be no long-term rise in prosperity or social progress unless the machinery now in use is rapidly augmented and improved.

Read this single statement, for instance, in the light of the present paper industry code: "To limit by license the further installation of machinery simply serves to enforce idleness among the workers who otherwise would be given employment; i. e., those in the machine tool and machinery industries." The truth of that statement is so obvious that the necessity for its insistence seems a bit juvenile. If the paper industry is not permitted to expand its production, that restriction reflects on the machine and tool industry, and that in turn keeps the machine and tool industry from using as much paper as they might, or from building machines for factories which do use paper.

Skipping over several pages of interesting and pointed facts, here are the two paragraphs which sum up the chapter under the heading The Long-Term Trend: "It is difficult to see (from the foregoing) how we can maintain both the rate of social progress and the improvement in economic well-being during the next thirty years without greatly augmenting the use of machinery and modern processes.

"Certainly without a vast increase in efficient productive equipment, maintenance of social and economic progress must shortly result in a tremendous shortage of effective man-power. Given any further restrictions upon invention and improvement we are in imminent danger of presently not having the productive power to sustain the long-term rise in the standard of living."

Following that logical conclusion, which becomes self-evident from the facts cited before, this little pamphlet illuminates the reader's mind by setting forth the actual number of job-holders who have lost their places through the installation of machinery—contrasted with the number of jobs created by that installation. During the ten years of 1920-1930, this booklet shows, more than 800,000 people lost their places due to changes and improvements in productive methods. Among these, for instance, were 309,000 draymen and teamsters, 134,000 millwrights and tool-makers, 74,000 dressmakers (in the homes), etc. But by way of contrast, there is shown, in the next page, a table of the trades which have benefited by the installation of machinery during the same period. And these total 2,264,000! Just one example: while the development of the automobile threw out of work some 309,000 draymen and teamsters it created jobs (during the same period) for 687,000 truck drivers and chauffeurs,—not to mention 365,000 mechanics, 35,000 garage helpers and 40,000 places in automobile factories—the latter all traceable directly to the installation of improved processing.

The paper industry, hand in hand with other industries, is up against the pressure of economic theorists. As many of us know, and as *The Job Ahead for Machinery* points out, no single industry or collection of industries can regain lasting prosperity without progress in both methods and capacity.

ADVERTISING PAGES REMOVED

THE PAPER INDUSTRY

A MONTHLY EDUCATIONAL JOURNAL

A Close-Up of Some Salesmen

as Seen by a Paper Mill Purchasing Agent

By A. H. FITZGERALD, Purchasing Agent
Kalamazoo Vegetable Parchment Company

PURCHASING agents, as a body, frequently are accused of being responsible for everything that has gone wrong with industry during the past three or four years. It has been my experience, however, that the seller has really been the guilty party as far as price cutting goes. Numerous instances are recalled where all I had to do was to sit back and listen without showing much enthusiasm about the transaction and the salesman would cut his price voluntarily.

Inasmuch as buyers have been cussed and discussed, I should like to point out a few of the things salesmen do that in my opinion are detrimental to good salesmanship. One of the most common faults with salesmen is that they stay too long and do not confine their talk to the product they are trying to sell. I do not know how other buyers feel on this point, but as far as I am concerned, I am not interested in a long discourse on the experiences the salesman had on his vacation, or a lot of gossip about things that do not concern our company's business. It would seem any salesman could complete his talk or demonstration in from five to eight minutes. In this length of time, he should be able to thoroughly convince himself that the buyer was or was not interested.

It is also a common fault for salesmen to want to make an experimental laboratory out of our plants. They will have a material or some article that they are not sure will fit into our process or mechanical set-up, yet they insist upon our trying it out. If we did this, we would cause ourselves a lot of grief and expense.

Then there is the matter of truthfulness. I do not know of any one thing that will build up faith and confidence in the seller's concern as quickly as a representative who will stick absolutely to the truth and admit the shortcomings of his product, if any. We have had a number of experiences where statements have been made that certain products would do certain things for us. Being a bit cautious, we conducted experiments in our laboratory to ascertain the truth of such statements, and found them to be absolutely untrue. It may sound almost incredulous, nevertheless, there are people still in business who are so short-sighted as to use such tactics.

Our company has always made it a policy to be quite particular about the concerns from whom we purchase, since we have found that as goes the reputation for square dealing and integrity of any concern, so goes the quality of its product. When we find the seller meets these specifications and his product is suitable for us, we seldom change our source of supply unless circumstances make it imperative to do so.

This next instance may sound exaggerated, but it would be surprising to many to know the number of salesmen who have only called on me two or three times, and who take it for granted the next time they call that all I have had to think about since they called last are them and their concerns, when the truth is the product they are selling is of no importance to me and I do not try to remember their names or the names of the companies they represent. This type of salesman will breeze into the office and with an air of familiarity ask how I am, perhaps talk a bit about the weather, and then ask if there is anything up in his line today. Of course, I will answer in the negative and he will leave without having mentioned his name, the company he represents or the product he is selling. I do not think any salesman should take it

for granted that the buyer remembers him or his product until the association has been so long established that there is no question about it.

Numerous cases are recalled where salesmen did not know as much about the product they were selling as the buyer did, with the result that it was quite embarrassing for the salesmen. It would seem a wise idea for any salesman to either get some actual experience by working in his company's plant or stay off the road until he has studied his product from every angle and is sure just what it will and will not do. The following is a case in point: A salesman was very enthusiastic about the coal he was selling and assured us we could make a decided saving by adopting it. He did not even know the type of equipment we had nor the characteristics of his coal. When he was told just what would happen if we put his coal in our plant, he was very much surprised and embarrassed.

Then, there is the matter of methods used by some concerns in handling rush orders. We, of course, never wire or telephone an order or ask for information unless we are in a rush for it. We assume the seller knows that having wired or telephoned, we are in a hurry for the material. It is surprising to know the number of instances where the order will not be followed up and where it is necessary to wire again to find out if it has actually been shipped, and, if so, the description of the shipment, routing, etc., for tracing. It would seem the personnel in any sales department would be trained to follow a rush order through until it was actually delivered to the customer and that they would wire information which they know the customer requires, as quickly as it is available to them.

Very recently, I had an experience, which, fortunately, does not happen very often with us. I telephoned a certain concern wanting to place an order for some material. There is only one man in that organization who is thoroughly familiar with our requirements. When the operator answered the call, I was told he was in conference and could not be disturbed. My reaction was to hang up the receiver and place the order elsewhere.

As a suggestion, it would seem many concerns would profit by putting their telephone operators through a course of training for the efficient handling of situations such as this which arise many times during a business day, and in some instances would prevent a valuable customer from being offended. In my opinion, a telephone operator holds a very important position as far as the sales of any company are concerned. There are many operators who handle a call so quickly and efficiently as to just make an inquirer want to place an order with the company.

Vertical Adjustment of Fourdrinier Part

By J. O. PARKS

IN these days of keen competition, the versatility of the modern fourdrinier, particularly on kraft, demands that it be adaptable to a range of 25-pound bag to 31-point board. With a horizontal table that is stationary, a range of these weights on kraft stock is not possible, because the highest test comes only after the stock is dragging. On a high head and high speed fourdrinier the necessary drag can be obtained by simply lifting the slice; but on slower speeds, 400 f.p.m. on 80-pound to 300 f.p.m. on 16-point, it is only possible to obtain it by changing the pitch, that is, having the wire run on an incline from the breast roll end.

Through such adjustment the slice velocity can be controlled almost at will; and on heavier weights, where necessary, the rush can be broken up at a point preferably about 7 tube rolls or 50 inches from the slice, in the next four feet come back to wire speed, and then slowly fall behind or drag just before the boxes. The handling of the stock on a machine in this manner gives the final sheet a higher test and more even caliper than can be obtained by lowering the head. Contrariwise, with the table level, it is almost impossible to get the desired formation, test, and even caliper by trying to regulate the flow on the wire through adjustment of the slices as the stock would rush almost to the boxes and result in a sheet with a low test, uneven caliper, and mottled appearance.

Using the incline as a means of resistance to flow speed places the water always under control all along the table, and allows the fibers, longer in suspension, to be under the maximum influence of the shake.

Although the incline for any particular weight is governed by machine speed, density, and freeness, it is well to note the pitch and couch vacuum after the desired weight and caliper have been obtained. It should be pointed out that the time required to get the desired pitch for any specific weight is less than is required to alter the speed when changing from one weight to another and that it is not uncommon in some modern mills to change from 25-pound at 900 f.p.m. to 16-point at 300 f.p.m.

The vertical adjusting fourdrinier part is actually indispensable in cases where it is necessary to produce such a wide range of weights on a single machine. It is also a great help in the manufacture of such sheets as 39-pound cement sack where both high bursting and tearing strengths are desired. In fact, this attachment alone has done more to further the success of fourdrinier on board than any one thing, it not being uncommon at present to produce 80 tons of 9-point in eight hours on one machine.

Identification and Microscopy of
Woods and Wood Fibers
Used in the Manufacture of Pulp*

By ELLWOOD S. HARRAR[1] and J. ELTON LODEWICK[2]

BECAUSE of their greater fibrous volume, their much longer individual fibers, and their relative ease of bleaching, the coniferous (non-porous) woods are usually preferred to hardwoods (porous woods) in the manufacture of high grade pulps and pulp products. There are, however, several woods of the porous type, which are suitable for the preparation of paper and related materials. At the present time, some of these woods are utilized only to a limited extent, but because of their ready availability promise to be an important source of raw material in the not too distant future. Others have been used in quantity since the development of the soda process.

Pertinent Features of Hardwoods

The hardwoods are separated from coniferous woods on the basis of the presence of pores, and the lack of definite radial alignment of the wood elements. Upon examination of the transverse sections of several hardwoods, it is apparent that they can easily be placed into two general groups: (1) those in which there is a definite band of large pores on the inner side of the annual ring; and (2) those in which the pores are of nearly equal size throughout the annual ring. The former are known as *ring-porous* woods (Fig. 1); the latter as *diffuse* porous (Fig. 2).

In the ring porous woods, the band of large pores corresponds to the springwood zone of the annual ring in coniferous wood. Pores are present in the outer or summerwood portion of the ring in these woods, but they are usually small and generally rather inconspicuous. In the diffuse porous woods the pores are ordinarily quite uniformly distributed throughout the annual ring, and there is little or no difference in size between those in the inner and outer portions. Consequently, there is no marked or well defined zonation in woods of this type. Toward the outer edge of the ring in diffuse-porous wood some of the cells, often only one or two rows, develop thick walls. These, by contrast to the thin-walled cells in the inner zone of the adjacent ring, provide differentation between the annual rings of growth.

Examination under magnification indicates that the pores are cross-sections of tube-like systems, termed *vessels*. These are formed by the partial or total disappearance of the horizontal or sloping end walls in a vertical row of cylindrical cells. The individual cells in any row are easily separated during pulping. These elements are often referred to as vessels, although they should be correctly called *vessel segments*, since they comprise only a portion of the vessel as it occurs in wood.

If the end walls of the vessel segments entirely disappear during coalescence, the result is a circular or oval pore between the segments. This is known as a porous opening or *simple perforation* (Fig. 1). When *coalescence* is partial, the end wall takes on the appearance of a grating and is known as a *scalariform perforation* (Fig. 2). The bars in such a grating may be few or numerous, and may be slender or rather broad. The type of perforation and the number of bars, if the opening is of the scalariform type, are features of diagnostic value. The end walls of the vessels when sloped appear in face view on radial sections and in sectional view on tangential sections.

The pitting on vessel walls is of two general types; one appearing as bordered, and the other exhibiting no discernable border. The pits connecting one vessel with another laterally are bordered and may be rather sparse

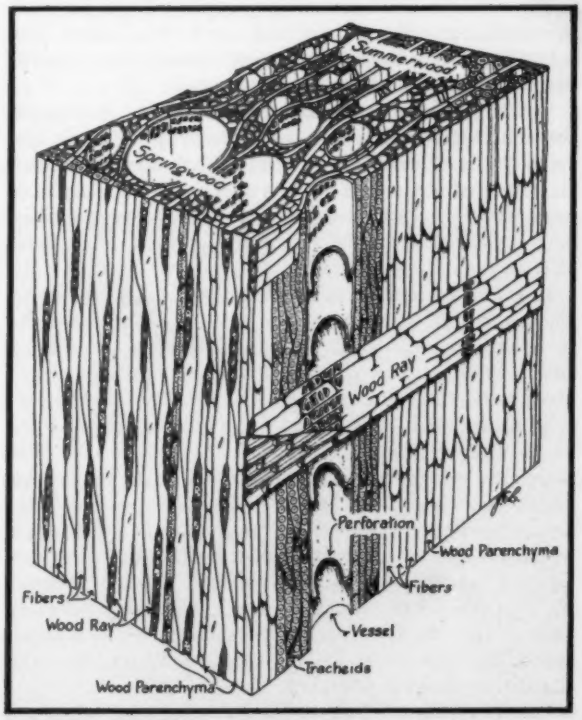

Fig. 1—Diagrammatic composite of Chestnut wood

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[2]In charge, Division of Forest Products, U. S. F. S., Northwest Exp. Station, Portland, Ore.

(*) This the second of a series of articles by these co-authors. Coniferous (non-porous) woods were considered in the first article of the series which appeared in the February, 1934, issue of this magazine.

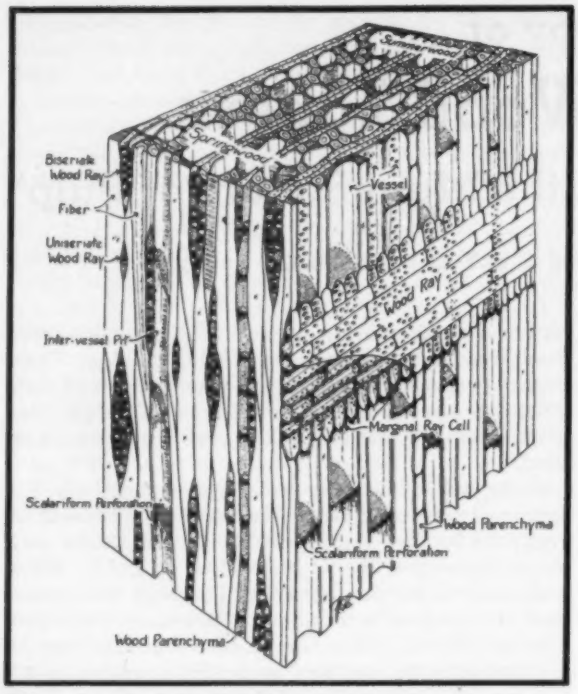

Fig. 2—Diagrammatic composite of Red gum wood

and circular in outline, or they may be so crowded that the borders become hexagonal, or elongated to give a scalariform appearance. In some woods, smaller bordered pits with oval borders may be discernible. These connect the vessel with other contiguous longitudinal elements such as fibers and tracheids. In the woods used for pulp, the unbordered pits are largely restricted to the radial walls because they communicate between the vessels and the cells of the wood rays. Such pits usually conform to a definite and characteristic grouping within a species.

Spiral thickenings, similar to those found in some of the coniferous woods are occasionally present on the vessel walls of certain hardwoods. Such structures may be restricted to the tips of the vessel segments, they may occur only where vessels contact other vessels, or they may appear throughout the vessel segments regardless of the type of contiguous elements.

It is not uncommon to find the vessels of many hardwoods partially or completely filled with water-white to pearly, rarely darkly colored, cell-like intrusions called *tyloses*. The walls of tyloses (singular tylosis) are usually thin, but may be considerably pitted in certain woods. As a rule thin-walled tyloses exhibit little or no pitting, while thick-walled tyloses, on the other hand, are not infrequently profusely pitted. Tyloses are formed only after the vessels lose their contents and before the living sapwood passes over to the dead heartwood. A single tylosis is formed by the wall of a contiguous parenchyma cell forcing itself through a vessel pit into the vessel cavity. This intrusion may progress only to the point where the tylosis appears as a bulge extending into the vessel, or it may continue until the the entire vessel is occluded.

Other types of longitudinally elongated elements often comprise a larger proportion of the volume in hardwoods than do the vessels. They make up the bulk of the fibrous elements in pulps, but differ in appearance in various woods to such a slight extent that they are of little diagnostic value. These fibrous cells are of three general types, the *tracheid*, the *fiber-tracheid*, and the *libriform* fiber. They represent a gradual evolution of the tracheid, a thin-walled conducting element, to the libriform fiber, a thick-walled strengthening (mechanical) element. All gradations may be found between the two extremes and no hard and fast definition for each can be made. The tracheids, as has been mentioned, have thin-walls and are further characterized by circular to rounded-hexagonal bordered pits. These elements are much shorter than in coniferous woods, and usually appear twisted and distorted along the grain as seen radially (Fig. 1). They are usually present in woods of the ring-porous type and then usually restricted to the immediate vicinity of the larger springwood vessels. The libriform fiber is very slender, extremely thick-walled, and possesses either no pits or only a few inconspicuous ones. When present, the pit orifice is minute and slit-like, in fact so much so that ruptures in the cell wall may not infrequently be mistaken for pits of this type.

Intermediate between these extremes is the fiber-tracheid. This has walls which vary from thin to relatively thick, and bordered pits with oval or elliptical orifices. Most hardwoods are comprised largely of these elements and they constitute the bulk of pulps from these woods.

Wood parenchyma in the hardwoods is similar in appearance to resin parenchyma in the coniferous woods. It consists of longitudinal tiers of brick-shaped cells placed end to end. The cells are usually thin-walled, and are distinguished from surrounding cells of other types by having the cell cavity wholly or partially occluded with organic matter. In some woods, small crystals, presumably of calcium oxalate are also included in the parenchyma cells. Wood parenchyma cells may appear hit and miss throughout the ring *(diffuse)*, in concentric rings or wavy tangential lines (diffuse-zonate), confined to the outer face of the seasonal ring *(terminal)*, or restricted to the vicinity of the vessels *(vasicentric)*.

The wood rays, the radial bands of tissue, are more conspicuous in most hardwoods than they are in the coniferous species. They may be invisible on the cross-section without magnification, or they may be very prominent even to the unaided eye. Wood rays are often only one cell in width *(uniseriate)*, two cells in width *(biseriate)*, or several to many cells in width *(multi-seriate)*. Most hardwoods have some uniseriate rays but in many of them the wider rays predominate.

The wood rays of the hardwoods may be composed of one or two types of cells. The most common, and the one making up the entire ray of many woods, is elongated radially. This is known as a *procumbent* ray cell. In many woods there are square or longitudinally elongated cells known as *erect* ray cells. This type is quite frequently restricted to the margins of the rays but may be interspersed between tiers of procumbent cells or flank them.

The broad face of the wood ray as seen on the radial face of a piece of wood, gives a characteristic appear-

Fig. 3—Tangential section of Black cottonwood, X-140

ance known as a *ray fleck*. This may be conspicuous or inconspicuous depending largely upon the height of the wood ray and its color in contrast with that of the associated longitudinal elements. Slight differences in the manner in which these flecks reflect light tend, in some cases, to make them stand out either because of their high lustre, or their variation in color.

Pith flecks, dark brownish patches of tissue resulting from the activities of certain insects known as cambial miners, are common to many porous woods, particularly the soft maples and the birches. On the cross-section these flecks appear as small dots of irregular outline. Along the grain they appear as straight or wavy narrow lines. Microscopically, the cells within these regions are extremely irregular in size and shape, and as a general rule, exhibit little or no uniformity in respect to wall thickness, pitting, or orientation of their longest axes.

Specific Characteristics of Hardwood Pulpwoods

Cottonwoods Including:

BLACK COTTONWOOD, *Populus trichocarpa* T. J. G. (Fig. 3.)

EASTERN COTTONWOOD, *Populus deltoides* Marsh. (Fig. 4.)

SWAMP COTTONWOOD, *Populus heterophylla* Linn.

Although occuring in widely separated regions, these three cottonwoods fail to exhibit any reliable features for their specific distinction. The black cottonwood, *Populus trichocarpa*, of the Pacific coastal region often produces wood which is somewhat darker than that produced by its two eastern congeners. Reliable microscopical differences, however, are not in evidence.

Gross Features—Sapwood undifferentiated from the white to greyish or brownish white heartwood; with a rather musty to sour odor; with little or no lustre; soft and light in weight; even grained.

Annual rings delineated by a narrow white to creamy brown line of parenchyma and denser fibrous tissue; pores solitary and radially paired for the most part, their orifices plainly visible without magnification *(x)*[3], (commonly occluded with tyloses); those in the springwood portion of the ring somewhat larger than those in the summerwood and in very wide rings often bordering on a ring porous type; fibrous tissue appearing to constitute somewhat less than half of the cross-sectional area; longitudial parenchyma other than the terminal type not evident at low magnification (10-x)[4]; wood ray of nearly uniform size, indistinct even with a lens; ray fleck, low and inconspicuous *(R)*[3], light brown.

Minute Anatomy—Vessels solitary and in short radial rows of 2-4; oval (x); often partially occluded with thin-walled, unpitted tyloses; vessel segments quite variable in length but always at least several times longer than broad; without spiral thickenings; perforations simple, oblique to nearly horizontal in the shortest segments; inter-vessel pits crowded, hexagonal (Fig. 3), with a broad border and horizontal oval to lenticular orifice. Fibers thin-walled for the most part (fiber tracheid type), with nearly circular to lenticular pits. Longitudinal parenchyma terminal, the cells forming a uniseriate (rarely in part biseriate) line on the outer face of the summerwood. Wood rays homogeneous; wholly uniseriate and up to 16-24 cells in height; pits leading to the vessels crowded, angular, usually in 2-4 staggered rows per cell.

Aspens Including:

ASPEN *Populus tremuloides* Michaux.

LARGETOOTH ASPEN *Populus grandidentata* Michaux.

The gross and minute features of these two species are similar to those described for the cottonwoods. Aspen wood is usually lustrous, and the pores are apt to be slightly smaller than those of the cottonwoods. There are, however, no reliable structural features which will lead to the positive identification of these species.

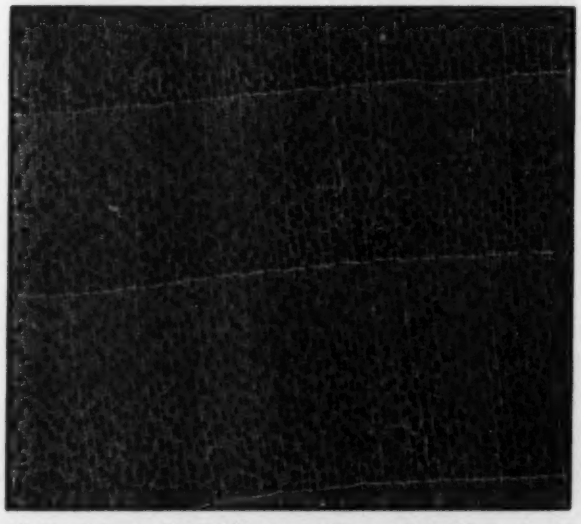

Fig. 4—Cross-section of Eastern cottonwood, X-15

[3] *(x), (R) and (T)* refer to the cross or transverse, radial and tangential sections respectively.

[4] Refers to a hand lens with 10 power magnification.

Black Willow *Salix nigra* Marsh.

The willows and the cottonwoods have been placed in the same botanical family known as the *Salicaceae*. Accordingly, one might expect to find the woods of these two groups exhibiting features common to both. Cottonwood timber and willow wood are structurally very similar, differing, as a matter of fact, in only one major respect.

Superficially, black willow wood differs from cottonwood and aspen lumber in the color of its heartwood which is generally reddish brown to light chestnut brown in color.

The woods likewise exhibit many common microscopic features but they may be easily separated on the basis of ray structure. Unlike the aspens and the cottonwoods, the willow ray is heterogeneous. The procumbent cells which make up the body of the ray are capped above and below by 1-2 rows of cells of the erect type. This feature is always suffice for positive distinction between the two groups.

Yellow Birch *Betula lutea* Michaux. (Fig. 5.)

Gross Features—Sapwood light brownish white, passing over rather gradually to darker brown, reddish-brown or flesh-colored heartwood; without distinctive odor or taste; somewhat lustrous; hard and moderately heavy; even grained.

Annual rings delineated by a denser zone of fibrous tissue; pores solitary for the most part, their orifices often visible without magnification, often occluded with tyloses or white amorphous deposits; fibrous tissue appearing to make up well over half of the cross-sectional area; longitudinal parenchyma not discernible at low magnification; wood rays indistinct without a lens, of nearly uniform width; ray fleck brown to reddish, relatively low but rather conspicuous, *(R)*.

Minute Anatomy—Vessels mostly solitary, but occasionally in short radial rows of 2-3; broadly oval to nearly circular *(x)*, partially occluded with thin-walled, unpitted tyloses or light colored or colorless amorphous infiltration; vessel segments often 10 or more times longer than broad; without spiral thickening; perforations scalariform, oblique, oval to broadly elliptical, with 8-20 or more thin, rarely branched bars; inter-vessel pits crowded, extremely small, with a narrow border and slit-like orifice, the orifices of several pits often confluent. Fibers thin-to thick-walled, with slit-like pits for the most part, their cavities often plugged with gummy infiltration. Longitudinal parenchyma diffuse and terminal, the cells of the former scattered throughout the tracts of fibrous tissue but most abundant in the summerwood, the cells of the latter forming a broken 1-2 seriate line on the outer face of the summerwood. Wood rays homogeneous; 1-4 seriate, and up to 28-36 cells in height; pits leading from ray cells to contiguous vessels crowded, small and appearing as normal bordered pits.

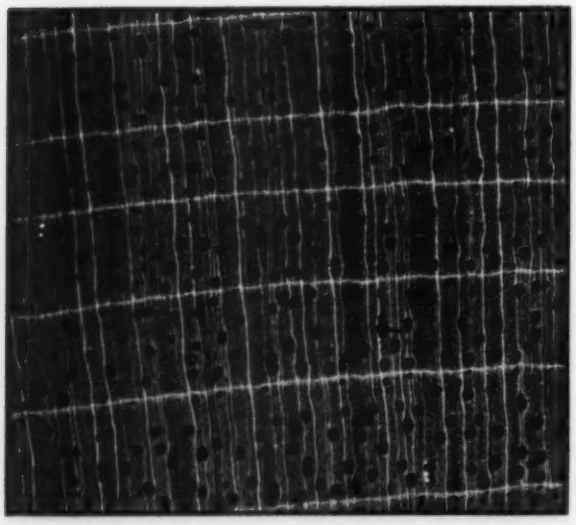

Fig. 5—Cross-section of Yellow birch, X-15

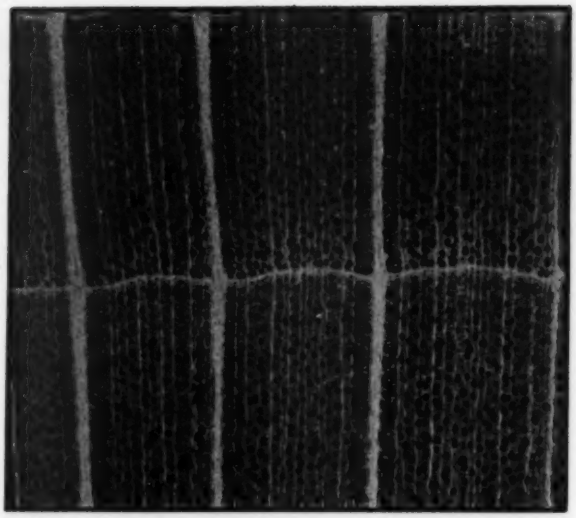

Fig. 6—Cross-section of Beech, X-15

Beech *Fagus grandifolia* Ehrt. (Fig. 6.)

Gross Features—Sapwood white to light reddish brown or brownish white, passing over gradually to darker reddish brown, to dark golden brown or reddish heartwood; without characteristic odor or taste; with little or no lustre; hard and moderately heavy; more or less even textured and straight grained.

Annual rings delineated by a zone of darker and somewhat denser fibrous tissue *(x)*; pores solitary and in more or less oblique radial rows or clustered, those in the springwood frequently the largest, their orifices indistinct or invisible without magnification, often occluded with tyloses; fibrous tissue appearing to make up approximately half of the cross-sectional area; longitudinal parenchyma occasionally visible without a lens and then as fine diffuse-zonated lines; wood rays of two sizes, the largest often two or more times the width of the largest pores, producing prominent reddish flecks on the quarter section *(R)*, often nearly ¼ inch in height, also appearing as reddish streaks on the faces of flat sawn timber *(T)*[3], smaller rays invisible without a lens *(x)*, and inconspicuous along the face of boards *(R & T)*.

Minute Anatomy—Annual rings delineated by a narrow zone of very thick-walled fibers. Vessels solitary and in radial to radially oblique rows of 2-several or in clusters of 3-10; oval to angular *(x)*; vessel seg-

ments relatively long often 10 to 20 times longer than broad; without spiral thickenings; perforations simple or occasionally scalariform in the summerwood vessel segments, in the latter instance with 3-7 relatively thick bars, oval to elliptical, quite oblique for the most part *(R)*; inter-vessel pits generally rather sparse and not crowded, round to oval, with a broad border and angular to oval orifice. Fibers thick-walled for the most part, with lenticular to slit-like pits, their lumina frequently occluded with gummy infiltration. Longitudinal parenchyma diffuse-zonated, the cells forming broken lines or festoons between the larger rays. Wood rays homogeneous to somewhat heterogeneous; extremely variable in size, 1-20 or more cells in width and 4-200 or more cells in height along the grain; pits leading from ray cells to contiguous vessels crowded, minute; the cells not infrequently occluded with dark gummy infiltration.

Chestnut *Castanea dentata* Borkh. (Figs. 1, 7.)

Gross Features—Sapwood light brown to greyish brown, passing over rather abruptly to the brown, olive brown, or reddish brown heartwood; with an astringent taste; with little or no lustre except that afforded by glistening tyloses in the vessel grooves along the faces of boards; soft, weak, and often quite brittle; uneven textured, the wood ring porous.

Annual rings evident, delineated by a zone of denser fibrous tissues and very large springwood pores of the

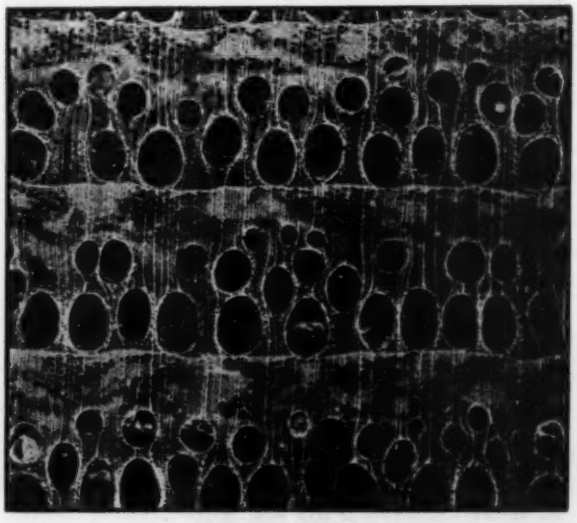

Fig. 7—Cross-section of Chestnut, X-15

next annual ring; springwood pores extremely large, 1-3 rows in width, their orifices plainly visible without magnification, commonly wholly occluded with tyloses, appearing as prominent grooves along the face of boards and giving to the boards a characteristic growth ring figure; summerwood pores abundant, in radial rows and flame shaped patches, their orifices not visible without magnification; fibrous tissue largely restricted to the summerwood; longitudinal parenchyma not visible at low magnification; wood rays fine and invisible without a lens; ray fleck low, olive-brown to silvery brown, inconspicuous.

Minute Anatomy—Annual rings delineated by a narrow zone of thick-walled, radially flattened fibers. Springwood vessels solitary for the most part, usually with contiguous tracheids, rays and longitudinal parenchyma; summerwood vessels in radial to radially oblique rows or in flame-shaped patches; vessel segments broader than long in the springwood, but usually many times longer than broad in the summerwood; perforations simple or rarely scalariform in the smaller summerwood vessels, and then with 2-5 thick bars; inter-vessel pits circular to oval, with a broad border and oval to angular orifice. Tracheids largely restricted to the immediate vicinity of the larger springwood vessels, thin-walled, often appearing greatly distorted and twisted *(R)*, profusely pitted on all walls. Fibers thin-walled, sparingly pitted. Longitudinal parenchyma diffuse and vasicentric in the springwood, often diffuse-zonate in the summerwood. Wood rays homogeneous; uniseriate or in part biseriate, the majority 10-18 cells in height.

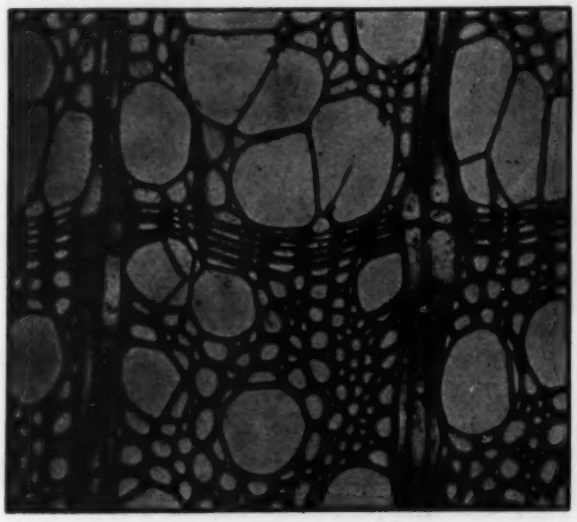

Fig. 8—Cross-section of Tulip poplar, X-180

Tulip Poplar *Liriodendron tulipifera* Linn. (Fig. 8.)

Gross Features—Sapwood grey to greenish white, often streaked with darker greys and black, passing over rather gradually to yellow, light greenish brown, brown to black and even tinged with purplish black streaks; without characteristic odor and taste; somewhat lustrous when freshly cut but darkening and dulling with age and exposure; soft and light in weight; straight grained and figureless.

Annual rings delineated by a very distinct white, greenish white or brownish white line of terminal parenchyma; pores solitary and in few-celled clusters, their orifices indistinct without magnification, of nearly uniform width throughout the rings, often occluded with tyloses; fibrous tissue appearing to make up somewhat less than 50 per cent of the cross-sectional area; longitudinal parenchyma other than terminal not visible at low magnification; wood rays of nearly uniform width, plainly visible without magnification, the largest about as wide as the largest pores; ray fleck relatively

high, silvery to silvery green in color, inconspicuous because of the lack of color contrast.

Minute Anatomy—Annual rings delineated by a narrow line of terminal parenchyma. Vessels solitary, clustered or less frequently in radial rows of 2-several; oval to round-polygonal or irregular *(x)*; occasionally

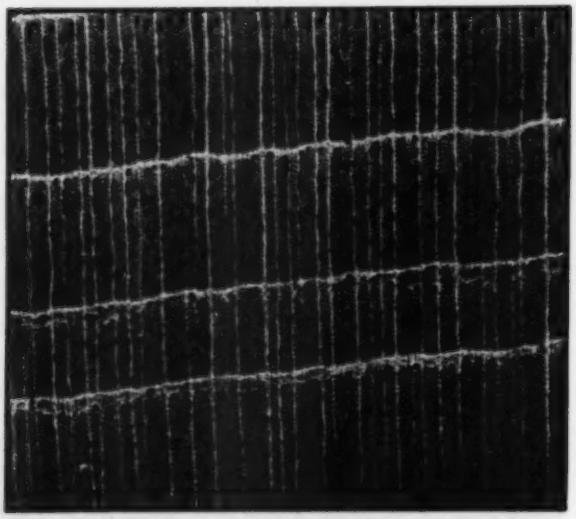

Fig. 9—Cross-section of Cucumber magnolia, X-15

occluded with thin-walled tyloses; vessel segments long, often 10 to 20 times longer than broad; without spiral thickenings; perforation scalariform oval, with 3-7 bars; inter-vessel pits round, oval to elliptical, with a broad border and horizontal orifice. Fibers thin-walled for the most part, commonly with forked ends; inter-fiber pits numerous, lenticular to slit-like and bordered. Longitudinal parenchyma terminal, the cells forming a 1-4 (mostly 1-2) seriate line between annual rings, not infrequently interpolated with thick-walled fibers. Wood rays heterogeneous; 1-3 cells wide and up to 40-60 cells in height *(T)*; erect cells marginal; pits leading from ray cells to contiguous vessels large, crowded, somewhat variable in shape.

Cucumber Magnolia *Magnolia acuminata* Linn. (Fig.9.)

The wood of this species, superficially at least, is very similar to tulip poplar wood. This might be expected, however, as these two species are both members of the same family, the *Magnoliaceae*. Microscopically, the wood of this species differs from the other in that it is somewhat denser, has slightly smaller pores, and the lines of terminal parenchyma are even more pronounced and frequently exhibit a pinkish green cast. Microscopically, cucumber magnolia exhibits two features which will serve as a positive means for its identification; these are, (1) simple perforations, and (2) scalariform inter-vessel pits.

The Evergreen magnolia, *Magnolia grandiflora* L. may be distinguished from the above two species on the basis of spiral thickening in the vessel segments.

Red Gum *Liquidambar styraciflua* Linn. (Fig. 2, 10.)

Because of the large amount of sapwood formed in some trees, much red gum lumber is in reality white to greyish in color. Hence in order to identify it in the trade, it is sold under the name of sap gum. The uniformly pinkish colored heartwood is commercially known as the red gum, but heartwood which is streaked with brown and black lines or localized regions of darker infiltration is generally distributed under the names of figured gum or satin walnut. Aside from their color there are no other distinctive differences.

Gross Features—Sapwood white to greyish, occasionally brownish white, passing over more or less abruptly to pinkish, reddish or variegated heartwood; without characteristic odor or taste; with little or no lustre; soft and light in weight; straight grained for the most part.

Annual rings indistinct; pores crowded, their orifices indistinct without magnification, frequently occluded with tyloses, of nearly uniform diameter throughout the ring; fibrous tissue appearing to make up less than ½ the cross-sectional area; longitudinal parenchyma not evident at low magnification; wood rays extremely numerous, crowded, visible without a lens, appearing to make up ½ of the cross-sectional area; ray fleck silvery brown to reddish brown, low and relatively inconspicuous.

Minute Anatomy—Annual ring not sharply defined even at high magnification, delineated by a narrow zone of thick-walled radially flattened fibers. Vessels solitary and in clusters of few to many; oval and angular *(x)*; often occluded with thin-walled, tyloses; vessel seg-

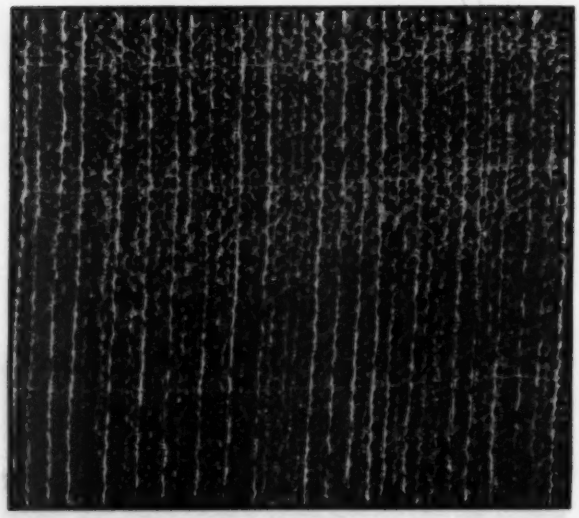

Fig. 10—Cross-section of Red gum, X-15

ments extremely long, frequently with spiral thickenings in the ends or tails; perforations scalariform, greatly oblique, oval to elliptical, often with as many as 25-35 thin bars; inter-vessel pits scalariform, with a wide border and narrow elliptical to slit-like orifice. Longitudinal parenchyma sparse, occasionally occluded with gummy infiltration. Wood rays heterogeneous; 1-4 (mostly 2) cells in width and up to 20-35 cells in height *(T)*, erect cells usually restricted to 1-2 marginal rows at the upper and lower extremeties of the ray; pits leading from ray cells to contiguous vessels relatively large, oval to elliptical in shape.

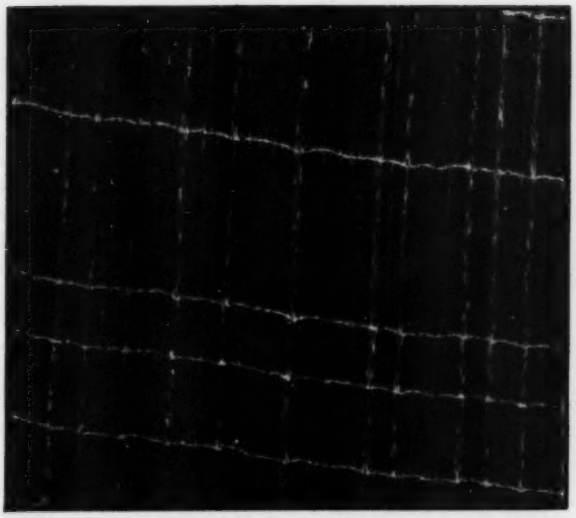

Fig. 11—Cross-section of Sugar maple, X-15

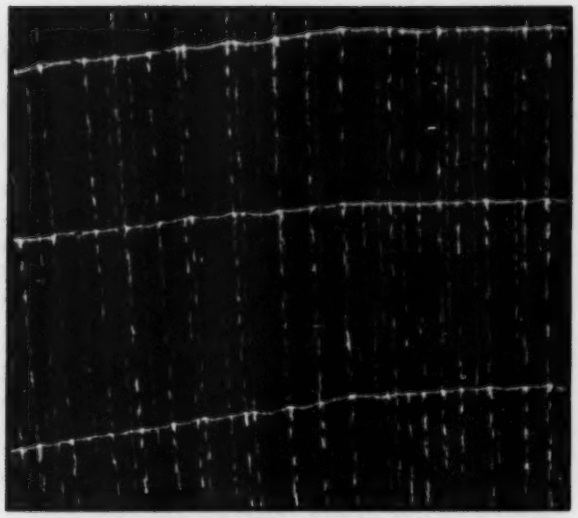

Fig. 13—Cross-section of Silver maple, X-15

Hard Maples Including:
SUGAR MAPLE, *Acer saccharum* Marsh. (Fig. 11, 12.)
BLACK MAPLE, *Acer nigrum* Michaux.

The black and sugar maples display a number of botanical characteristics which permit of their distinction in the field. Their timbers, however, are extremely similar, in fact, they exhibit no satisfactory features for their separation; in the trade they are usually sold in mixture under the trade names rock maple, sugar maple, or hard maple. Hence, for reasons of convenience, the descriptions of these two species have been combined.

Gross Features—Sapwood more or less undifferentiated from the flesh colored to pinkish, pinkish brown, or light reddish brown, heartwood, without distinctive odor or taste; hard and heavy; relatively fine and even grained.

Annual rings delineated by a pinkish to reddish line; pores solitary for the most part, their orifices not visible without magnification (x), not crowded, occasionally occluded with tyloses or gummy infiltration; fibrous tissue in extensive tracts and appearing to make up well over half of the cross-sectional area; longitudinal parenchyma not visible at low magnification; wood rays of variable width, the largest plainly visible without magnification, pinkish, about 1½-2 times as wide as the diameter of the largest pores; ray fleck reddish to pinkish brown, relatively high and rather conspicuous.

Minute Anatomy—Annual rings delineated by a narrow zone of thick-walled fibers and small amounts of terminal parenchyma. Vessels solitary and in short radial rows of 2-3; oval (x); vessel segments short, often only 2-3 times longer than broad; generally with spiral thickenings; perforations simple, more or less oblique; inter-vessel pits crowded, hexagonal *(T)* with a broad border and nearly horizontal slit-like to narrowly elliptical orifice. Fibers thin- to thick-walled in the outer portion of the ring, occasionally pitted. Longitudinal parenchyma terminal and diffuse, in the latter instance commonly contiguous to vessels as vasicentric parenchyma, the cells thin-walled and commonly occluded with gummy infiltration. Wood rays homogeneous; 1-8 (mostly 5-7) cells in width, the largest 50-75 or more cells in height; pits leading from ray cells to contiguous vessels large, angular to broadly oval, more or less crowded; gummy infiltration occasionally present in small amounts.

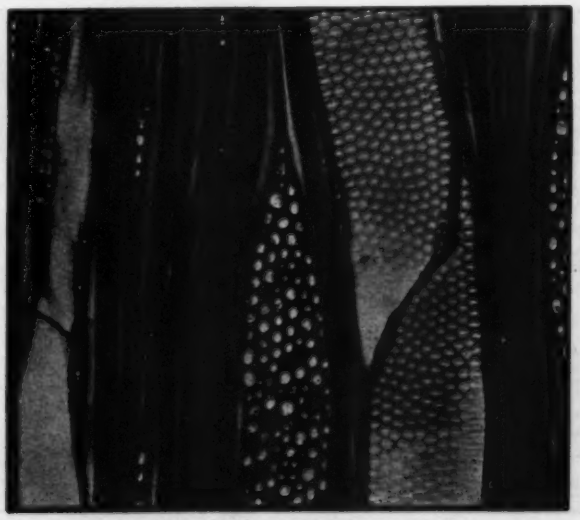

Fig. 12—Tangential section of Sugar maple, X-180
Note spiral thickening in smaller vessel

Soft Maples Including:
SILVER MAPLE, *Acer saccharinum* Linn. (Fig. 13.)
RED MAPLE, *Acer rubrum* Linn.

These two maples are likewise similar in both their physical and anatomical features, hence their descriptions will also be combined.

Gross Features—Sapwood white to greyish, gradually replaced by pinkish brown, purplish brown, or greyish red heartwood, not infrequently tinged with greenish brown or purplish hues; without characteristic odor or taste; moderately hard and heavy; fine and even grained.

Annual rings delineated by a pinkish to dull reddish brown line of tissue; pores solitary for the most part, not crowded, their orifices indistinct without a lens, occasionally occlud-

ed with tyloses. Fibrous tissue in extensive tracts, appearing to make up well over half the cross-sectional area; longitudinal parenchyma not evident at low magnification; wood rays of nearly uniform width, plainly visible without magnification; ray fleck reddish brown, lustrous, rather conspicuous *(R)*.

Minute Anatomy—Annual rings delineated by a narrow zone of thick-walled fibers and terminal parenchyma. Vessels solitary and occasionally in radial rows of 2-3; oval to nearly circular *(x)*; vessel segments generally 10 or more times longer than broad; with prominent spiral thickenings; perforations simple, more or less oblique; inter-vessel pits crowded, hexagonal *(T)*, with a broad border and nearly horizontal slit-like orifice. Fibers thin- to thick-walled, with narrow slit-like bordered pits. Longitudinal parenchyma terminal and diffuse, in the latter instance commonly contiguous to vessels as vasicentric parenchyma, the cells thin-walled and commonly occluded with gummy infiltration. Wood rays homogeneous, 1-5 (mostly 2-4) cells in width, the largest up to 50 or more cells in height; pits leading from ray cells to contiguous vessels large, angular to broadly oval, more or less crowded; gummy infiltration occasionally present in small amounts.

Basswood *Tilia glabra* Vent. (Fig. 14.)

Gross Features—Sapwood undifferentiated from the creamy white to light brownish white heartwood; with a rather musty odor; somewhat lustrous; soft and light in weight; relatively straight and even grained.

Annual rings delineated by a narrow zone of dense fibrous tissue and fewer pores; pores more or less indistinct or invisible without magnification, solitary or variously clustered, occasionally occluded with tyloses; fibrous tissue appearing to make up about half of the cross-sectional; longitudinal parenchyma not evident; wood rays of two sizes, the larger plainly visible without magnification and appearing to be as wide as the largest pores; ray fleck light brown, high and relatively conspicuous.

Minute Anatomy—Annual rings delineated by 3-5 rows of somewhat thicker radially flattened fibers. Vessels solitary and in clusters or radial to radially oblique rows of few to several, often occluded with tyloses, those in the inner portion of the ring the largest; vessel segments short to long, with spiral thickenings; perforations simple oval, horizontal to oblique; inter-vessel pits rounded hexagonal, with a broad border and nearly circular orifice. Fibers thin- to somewhat thicker-walled in the outer portions of the ring, the pits slit-like, with little or no border. Longitudinal parenchyma abundant, diffuse zonate, the cells forming uniseriate wavy tangential lines at frequent intervals; wood rays homogeneous; often flaring at the ring boundaries; 1-5 seriate, the larger rays up to 75-100 plus cells in height; pits leading from ray cells to contiguous vessels, small, nearly circular, somewhat crowded and usually appearing as normal bordered pits.

Black Gum *Nyssa sylvatica* Marsh. (Fig. 15.)

Gross Features—Sapwood white to ivory-white or greyish white, passing over more or less abruptly to darker greyish white to grey heartwood; without characteristic odor and taste; lustrous; hard but relatively light in weight; with strongly interlocked grain.

Annual rings rather indistinct at low magnification; pores more or less indistinct or invisible without magnification, without tyloses; longitudinal parenchyma not evident at low magnification; wood rays plainly visible without a lens, appearing to constitute about half of the cross-sectional area; ray fleck rather inconspicuous.

Minute Anatomy—Annual rings not sharply defined even at high magnification, delineated by a narrow zone of thick-walled, radially flattened fibers. Vessels solitary, paired and in clusters of few to several; oval to polygonal *(x)*; vessel segments extremely long for the most part; without spiral thickenings; perforations scalariform, very oblique, oval to broadly elliptical, with 20-50 thin to relatively thick bars; inter-vessel pits, oval to elliptical, with a broad border and oval to

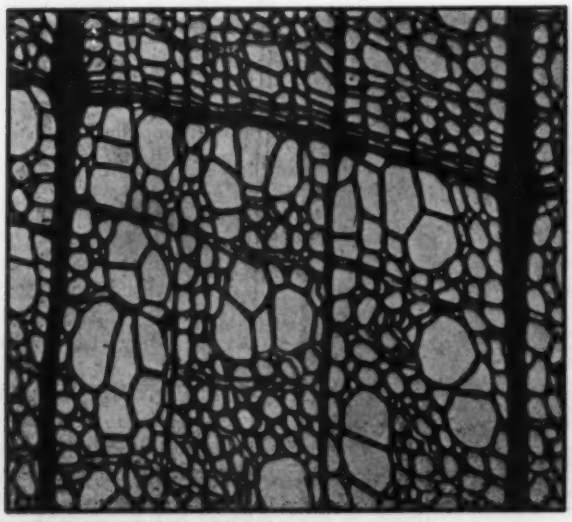

Fig. 14—Cross-section of Basswood, X-80. Note flare in wood rays at the ring boundary

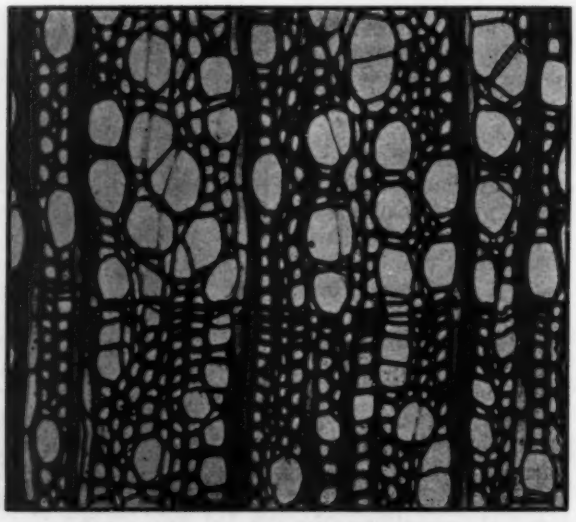

Fig. 15—Cross-section of Black gum, X-80

elliptical orifice. Fibers thin-walled for the most part with minutely bordered pits. Longitudinal parenchyma diffuse, the cells scattered through the tracts of fibrous tissue, occasionally contiguous to vessels as vasicentric parenchyma, frequently occluded with dark colored infiltration. Wood rays; heterogeneous; 1-2 seriate, the largest 25-35 cells in height; pits leading from ray cells to contiguous vessels, oblong, angular and oval, often crowded.

The procedure and methods of preparing woody tissue for microscopic examination were outlined in the initial article of this series. —EDITOR.

KEY TO THE POROUS PULPWOODS

1. Wood ring porous; i. e., with springwood pores much larger than summerwood pores resulting in two rather distinct porous zones within the annual ring....**Chestnut**
1. Wood diffuse porous; i. e., with springwood and summerwood pores of nearly uniform diameter resulting in a uniform distribution of pores throughout the ring. 2
2. Wood rays in part extremely broad, the largest at least twice as wide as the largest pores, very prominent on both the radial and tangential surfaces; vessel segment perforations both simple and scalariform, in the latter instance with few thick bars.....**Beech**
2. Wood rays sometimes rather broad but never more than as wide as the largest pores, often rather evident on the radial section but always rather inconspicuous on the tangential section; vessel segment perforations simple or scalariform but never both within the same species 3
3. Wood rays plainly visible without magnification..... 4
3. Wood rays rather indistinct or invisible without magnification 11
4. Wood rays appearing to make up one-half of the cross-sectional area; annual rings rather indistinct 5
4. Wood rays appearing to make up much less than one-half of the cross-sectional area; annual rings well defined..... 7
5. Wood pinkish, light reddish brown, often with darker streaks of brown and black; usually straight grained. .....**Red Gum**
5. Wood white, greyish white, brownish white or distinctly greyish; straight or interlocked grained..... 6
6. Wood white to brownish white, straight grained; inter-vessel pits scalariform; wood rays occasionally more than 2 cells in width.. .....**Sap Gum**
6. Wood greyish white to dark grey, interlocked grained; inter-vessel pits oval to elliptical; wood rays never more than 2 cells in width.. .....**Black Gum**
7. Wood greenish yellow, light green, greenish brown or greenish black; soft; seasonal rings delineated by a white, brownish white greenish white or light pinkish green narrow but prominent line of terminal parenchyma 8
7. Wood reddish brown, pinkish brown, greyish-pink, to flesh colored, occasionally tinged with shades of green and lavender; seasonal rings delineated by reddish brown to pinkish brown line of dense fibrous tissue...10
8. Vessels with spiral thickenings, scalariform perforations and scalariform inter-vessel pits. .....**Evergreen Magnolia**
8. Vessels without spiral thickenings..... 9
9. Perforations simple; inter-vessel pits scalariform.... .....**Cucumber Magnolia**
9. Perforations scalariform; inter-vessel pits oval to elliptical .....**Tulip Poplar**
10. Wood rays variable in size, the smallest more or less indistinct; vessel segments short for the most part.....**Sugar Maple** ..... **Black Maple**
10. Wood rays of nearly uniform width; vessel segments generally quite long for the most part .....**Silver Maple** ..... **Red Maple**
11. Wood rays appearing to make up one-half of the cross-sectional area; annual rings rather indistinct.....12
11. Wood rays appearing to make up much less than one-half of the cross-sectional area; annual rings distinct and well defined.....14
12. Wood pinkish, light brown, often with darker streaks of brown and black; usually straight grained.....**Red Gum**
12. Wood white; greyish white, brownish white or distinctly greyish; straight or inter-locked grained 13
13. Wood white to brownish white; straight grained; inter-vessel pits scalariform; wood rays occasionally more than 2 cells in width.....**Sap Gum**
13. Wood greyish white to dark grey; interlocked grained; inter-vessel pits oval to elliptical; wood rays never more than 2 cells in width.....**Black Gum**
14. Wood rays plainly visible under the lens.....15
14. Wood rays indistinct even under the lens.....16
15. Wood hard and moderately heavy; perforations scalariform; spiral thickenings absent.....**Yellow Birch**
15. Wood soft and light in weight; perforations simple; spiral thickenings present and very prominent.**Basswood**
16. Woods white to greyish or brownish white in color; more or less lustrous; wood rays homogeneous .... **Black Cottonwood** ..... **Swamp Cottonwood** ..... **Eastern Cottonwood** ..... **Aspen** ..... **Bigtooth Aspen**
16. Wood brown to reddish brown in color; wood rays heterogeneous .....**Black Willow**

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Natural Aging of Paper Compared with Aging by Heating

In an investigation of the permanence of papers conducted at the National Bureau of Standards, additional information has been obtained which indicates that heating paper at an elevated temperature provides a convenient means of accelerating the normal aging effects which take place in papers kept under favorable storage conditions.

A wide variety of writing papers and some book papers were retested after four years of normal aging for chemical purity and strength. Many of the papers had suffered marked change in strength, particularly in folding endurance. The papers were placed by normal aging in approximately the same order of stability foretold by the accelerated aging tests conducted four years previously. This test determines the effect of a heat treatment at 100 deg. C. for 72 hours on various physical and chemical properties, but particularly on the folding endurance since it is one of the properties most sensitive toward heat or normal aging. In general, the papers with the highest chemical purity were the most resistant to deterioration by heat or normal aging, while those with the least desirable initial properties underwent the more rapid deterioration.

The article reporting these findings was published in the December, 1933 issue of the *Bureau Journal of Research*. Separate prints can now be secured from the Superintendent of Documents, Washington, D. C.

Cause and Effect of Improper Drying on Paper Machines

By WILLIAM V. KNOLL,
Vice President
Midwest-Fulton Machine Company

THE drying of paper is the function of the steam inside the dryer cylinders.

A literal interpretation of this fundamental function would mean that so long as a sufficient amount of steam was injected into the dryers, there would be no drying problem. If one may judge from the evidence, a great many papermakers still take this view of the situation and appear to be content to let nature take its course. When things go wrong, as they often do under such conditions, they invariably look for causes other than the improper use of steam for drying.

A great deal of hokum and misleading propaganda on this subject has been inflicted on the paper industry from time to time. This has resulted in creating a confusing situation and is largely responsible for a wholly unjustified skepticism toward the logical solution of the drying problem.

Years ago, before deadly competition and excessive production had forced a policy of rigid operating economy, there was no drying problem of any consequence to confront the papermaker. The steam was introduced at the dry end of the paper machine and discharged to the atmosphere at the wet end. Quite simple and effective, because the velocity of the steam passing in and out of every dryer swept with it continuously all the air and condensate, and thus maintained the maximum heat transfer from the steam to the dryer surface. At the same time, it provided a logical temperature curve, gradually decreasing toward the wet end.

No mill today, however, could afford such an expensive procedure to obtain satisfactory drying conditions. Consequently, as competitive conditions increased, all sorts of contraptions and expedients were developed in an effort to reduce excessive drying costs, usually by some method of restricting the free passage of the steam from the dryer, in an attempt to conserve steam.

These expedients invariably brought about an entirely new set of conditions and, incidentally, drying troubles. They still exist on many paper machines, but, strangely enough, they are not always recognized as drying problems. This may be accounted for by the fact that drying troubles do not occur over night, but accumulate gradually over the years, as new standards in quality and machine production add to the ever-increasing difficulties of producing a uniform quality at a profitable rate of production.

Causes of Improper Drying

A clear understanding of the subject of drying, however, requires only the application of a little common sense

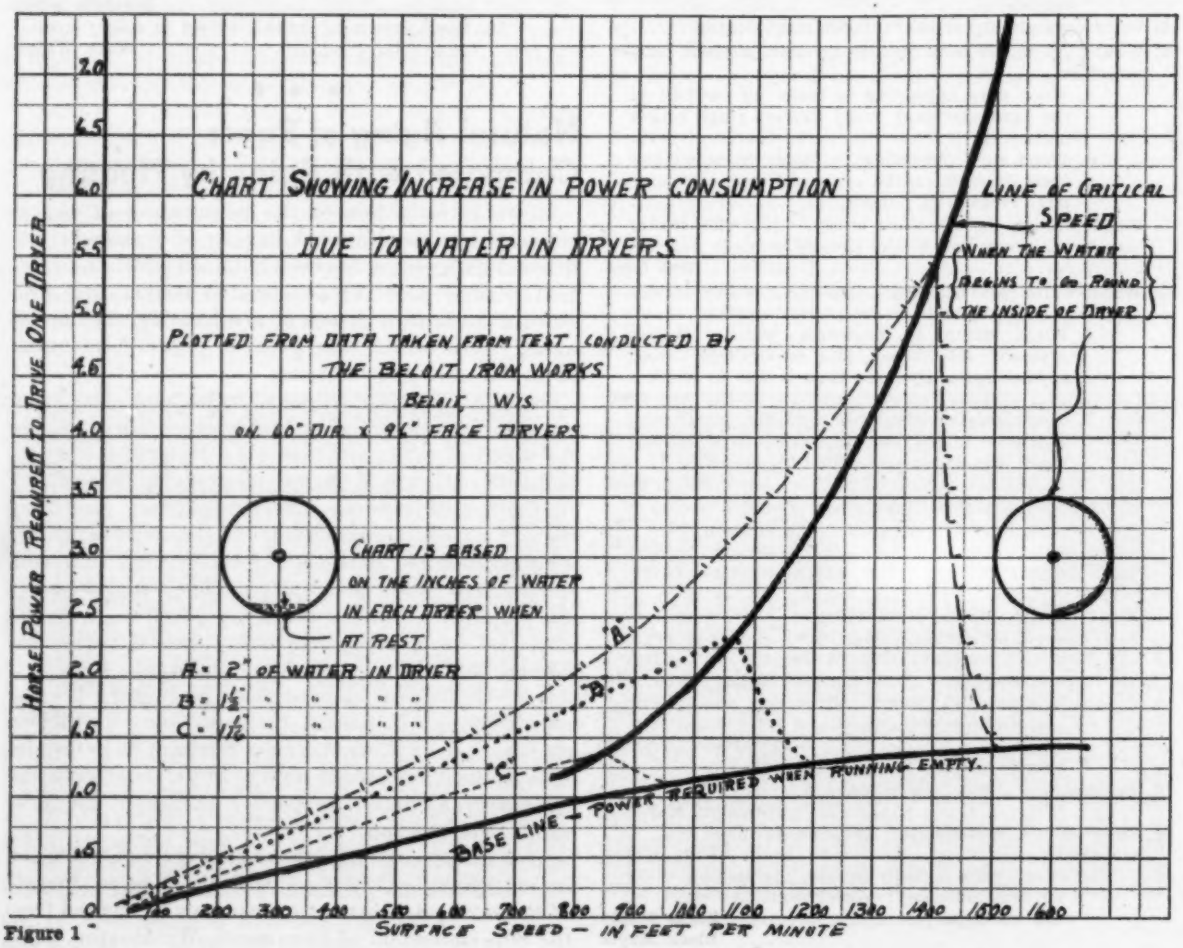

Figure 1

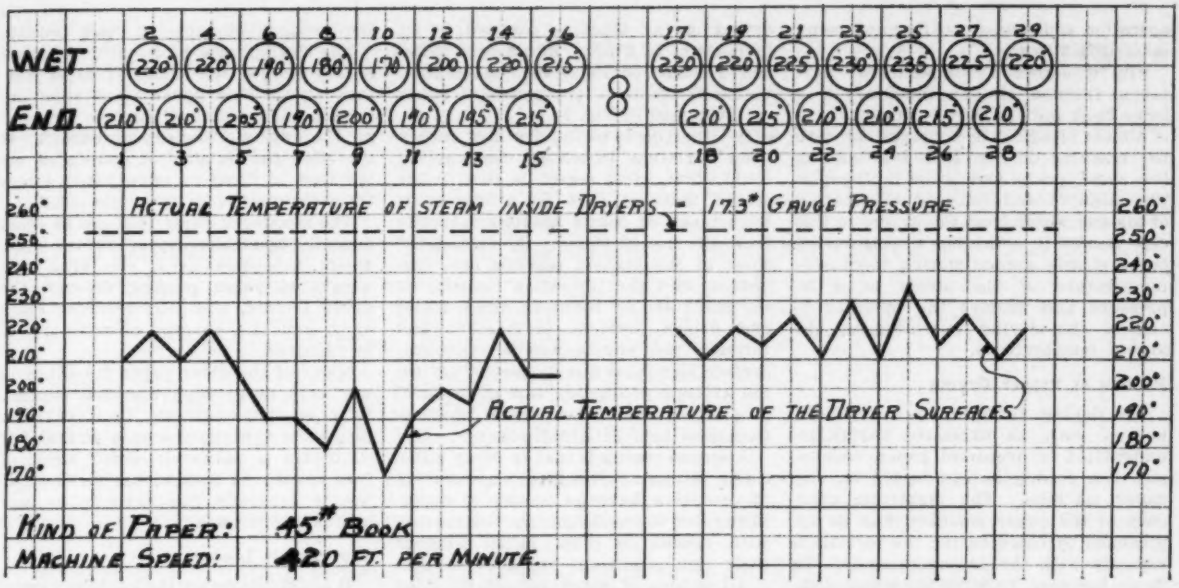
WET END
ACTUAL TEMPERATURE OF STEAM INSIDE DRYERS - 173# GAUGE PRESSURE
ACTUAL TEMPERATURE OF THE DRYER SURFACES
KIND OF PAPER: 45# BOOK
MACHINE SPEED: 420 FT. PER MINUTE.

Fig. 2—Poor drying conditions on book machine with twenty-nine 48-in. diameter by 76-in. trim dryers

and an open mind. Steam cannot be introduced into a closed vessel, such as a drying cylinder, and remain bottled up there in the expectation of obtaining constant and uniform results in heat transfer to the dryer surface.

To appreciate the subject as a whole, all of the factors detrimentally affecting the drying of paper must be taken into consideration. Most of the important fundamental ones may be listed as follows:

1—Air in the dryer cylinder.
2—Water in the dryer cylinder.
3—Poor circulation of the steam through the dryer section.
4—No graduation of temperatures at the wet end section.
5—Excessive drying temperatures.
6—Poor ventilation around the dryer.
7—Bad syphons.
8—Poor felt drying conditions.
9—Excessive moisture in the sheet before entering dryer section.
10—Improper stock preparation.

The first five factors are due solely to the improper use of the steam inside the dryer cylinder, although it is perhaps excusable for the papermaker to place the blame for poor results on one or more of the last five and to discount the detrimental effect of the first five. Nevertheless, the first five factors are often the most important to the papermaker in his effort to maintain profitable operation.

Results of Improper Drying

With such an impressive list of factors causing imprpper drying, it should not be difficult to realize how greatly any individual factor, or a combination of these factors, will quickly develop a number of operating troubles definitely affecting either the quality of the sheet, the rate of production, steam costs, or all of them together.

The results of improper drying are not only fundamental and exceedingly expensive, but are accumulative from the standpoint of affecting both quality and quantity. Some of the most common results, based on the first five factors are:

1—Low drying rate, due to poor heat transfer to dryer surface.
2—Excessive steam consumption, due to air and water in dryers.
3—High broke losses, due to variable temperature conditions.
4—Excessive shrinkage, due to uncontrolled wet end temperatures.
5—Cockling, due to uneven drying temperatures.
6—Rejections, due to underdried paper and uneven temperatures.
7—Loss of strength, due to excessive drying temperatures.
8—Curling, due to variation in moisture content of the sheet.
9—Lowered production, due to delays caused by frequent breaks.

Effect of Water and Air in Dryers

Water is a poor conductor of heat. Its capacity to transmit heat is only 1/85 that of the iron in the dryers. Unless there is a rapid circulation through the dryers, a film of oil, water and sludge will adhere to the inner surfaces, a condition which requires the use of more steam at higher pressure to dry the paper, because some of the available heat in the steam is used in penetrating and overcoming the resistance of the oil and water.

Water in dryers also increases the power load required to drive the dryer section. Exhaustive tests by engineers of The Beloit Iron Works of Beloit, Wisconsin, show how definitely the load increases. Fig. 1 indicates the increased power consumption per dryer according to the amount of water in it. Good syphons, of course, are of primary importance, but they are not in themselves capable of removing the water and air.

Air is a first class insulator of heat. A film of air interposed between the steam and the metal of the dryer renders the heating surface useless for drying purposes. The iron in the dryer will conduct about two thousand times more heat than the air will conduct. Air also tends to prevent even distribution of the steam in the dryer by forming in air pockets and causing the sheet to dry unevenly across the machine. Air binding is the greatest source of trouble in paper drying and the most difficult to overcome. The ordinary apparatus designed for the separation of condensate from steam is not capable of handling the large and varying amount of air present in paper machine dryers.

When the dryers on a paper machine are partly filled with water or air, the result is a loss in production, greater steam consumption, and a varying, inferior quality of paper. The operation of the dryers will be intermittent; that is, they will alternately become partly filled with water and cool off, then suddenly discharge the water and heat up. As the sheet strikes the hot dryers, it contracts too rapidly and becomes strained or cockled, or often broken, while other places in the sheet are too wet. It is impossible to produce a satisfactory sheet of paper efficiently unless all of the dryers on the paper machine are working properly, which means that the water of condensate and air are constantly and completely removed.

The temperature chart shown in Fig. 2 was taken from a machine in a large book mill in Pennsylvania. The wide difference between the actual temperature of the steam inside the dryers and the temperatures of the dryer surfaces in contact with the paper illustrates the result of poor heat transfer, caused by the presence of air and water in the cylinders. Such a condition of course prevents close control of the drying

operation and causes cockling and many other difficulties.

Fig. 3 shows a temperature chart taken from a similar machine in a large book mill in Ohio. This machine is almost identical in arrangement with the machine of Fig. 2, and is making the same grade and weight of paper. The positive and constant elimination of air and water from the dryers in this case results in obtaining a temperature curve closely approximating the inside temperature of the steam at 0 lb. pressure and enables the operator to control the drying operation at the lowest temperatures.

Factors of Proper Drying

All drying troubles of a technical nature, such as excessive shrinkage, underdried or overdried paper, cockles, etc., can readily be eliminated on any paper machine. The maximum efficiency of the paper machine may be approached by coordinating the formation capacity with the drying capacity. To do so, however, requires the accomplishment of the following:

1—Create a rapid and positive circulation of steam through every dryer.

2—Positively remove all condensate continuously and steadily.

3—Induce a complete removal of all air and non-condensable gases from dryers.

4—Maintain a graduated drying temperature on the wet end dryers.

5—Secure the maximum heat transfer to dryer surface at steam pressures used.

6—Provide a positive control of drying conditions.

7—Insure a uniform surface temperature across the face of each dryer.

8—Dry the paper at the lowest possible temperatures consistent with maximum operating speeds.

9—Utilize every pound of steam without waste.

Steam Consumption

The drying operation is not only important from the standpoint of quality, but usually represents one of the larger items in the cost of production. Considering this fact, it is astonishing to find how few mills have taken even ordinary steps to ascertain their drying costs. Generally, no detailed analysis of plant steam consumption is maintained other than the daily record of the steam plant coal consumption.

It is not surprising therefore to discover that there exists a wide variation in steam consumption, with respect to the steam used only for drying the paper. This variation will range from 1.75 lb. of steam to 5 lb. of steam for each pound of paper dried, on machines in competitive mills making exactly the same general grades and weights of papers.

Fig. 4 illustrates how the presence of air and water in dryers increases steam consumption and retards production. The steam consumption of the machine upon which the chart was developed averaged 4.4 lb. of steam for each pound of paper produced, while the elimination of air and water from the dryers of the machine resulted in an increase of 50 f. p. m. in machine speed and a reduction in steam consumption to 2.2 lb. of steam per pound of paper as illustrated in Fig. 5.

It is pertinent to inquire how such a wide variation in steam consumption could occur. One reason is that in the second instance (Fig. 5) proper steps were taken to obtain maximum results from the use of steam. By drying the sheet at the highest possible rate consistent with the formation capacity of the machine; by reducing broke losses and delays incident to breaks; and through the elimination of technical surface blemishes due to uneven drying, the average production was maintained at a high rate and the steam consumption thus held at a minimum.

A second reason is that in many mills, those charged with the responsibility of operation have no means or opportunity for determining, by comparison with results in other mills, whether their own conditions are good or bad.

All grades of paper cannot be dried properly or successfully at a rate of 1.75 lb. of steam per pound of paper. On the other hand, no drying operation should require anything approaching 5 lb. of steam per pound of paper for the ordinary grades and weights.

Only a careful analysis of existing conditions, by competent engineers possessing extensive records of comparative results on machines making similar grades, will determine whether the steam consumption of any given machine may be improved to the fullest extent.

It is important to note that for each half pound of steam used to dry a pound of paper, average steam costs are increased approximately 25 cents per ton of paper passing over the machine.

Rate of Production

The economic value of any given paper machine, as a producer of revenue, is determined from the amount of marketable paper obtained through its use. Its productive capacity fixes the direct cost of the paper with respect to capital investment, power, labor, maintenance, and time.

If the same machine is altered or improved to produce a still greater amount of paper per day, its economic value is increased, while the per pound cost of paper is reduced proportionately.

From the standpoint of drying, the productive capacity of a paper machine can be radically affected to an extent hardly appreciated by the average papermaker. As has been pointed out, air and water in the dryer cylinders will prevent a proper transfer of the heat in the steam to the dryer surface. This condition will affect the surface temperature from fifteen to fifty degrees at any given steam pressure. (See Figs. 2 and 3)

A full appreciation of the failure to remove the condensate and air continuously from dryers may be gathered from the statement that most existing paper machines could dry from 10 per cent to 30 per cent more paper, by providing drainage facilities for the accomplishment of this result.

The drying rate of a paper machine is based upon the trimmed dryer surface area. This figure is obtained by taking the combined surface area of all the dryers. The drying capacity is therefore the number of pounds of paper that is dried in twenty-four hours for each square foot of surface area.

The amount of paper that can be dried depends upon the dryer surface area, steam pressures used, the kind and weight of paper passing through the dryer section, the heat transfer efficiency, and the amount of moisture to be removed.

Many of the older paper machines in use have never been operated successfully at the maximum limit of their formation capacity, because of inability to obtain a uniformly dried sheet at that speed. In such instances, the failure is generally due entirely to poor drainage equipment.

Preventable Losses

It is not altogether the operating speed of a paper machine that determines profitable production. A machine may be operated at the maximum limit of its formation capacity, but the amount of marketable paper that is actually produced is the governing factor, regardless of machine speed. Common sense would naturally dictate a reduction in the machine speed to coincide with the drying capacity, or to eliminate excessive broke losses or rejected paper.

Considered from this standpoint, only a paper machine running at its maximum formation capacity, that is also drying the paper properly, uniformly, and acceptably at this speed, can be termed efficient. (Fig. 6)

Excessive broke losses and production losses due to delays caused by breaks are almost invariably traceable to improper drying. Losses of this nature may be the result of excessive shrinkage at the wet end, which in turn sets up a train of other operating difficulties, such as cockles, wet streaks, loss of strength, due to excessive initial temperatures, etc.

Since it is essential to maintain the highest possible rate of production, many papermakers are forced to overlook the possibility of delays incident to frequent breaks on the paper machine, and continue to operate at a speed beyond the economical rate of production. It is, therefore, not uncommon to note a wide difference between the theoretical daily production at a given machine speed, and the actual tonnage of marketable paper produced at that speed over a twenty-four hour period. The difference between the two may vary from 5 per cent to 20 per cent of the total daily output.

Naturally, a papermaker is loath to admit that he is subject to excessive broke losses or delays caused by breaks, and the discrepancy is often covered up or ignored as a necessary evil.

Where losses of this nature occur, they can be materially reduced, and the average daily production increased proportionately without increasing the ma-

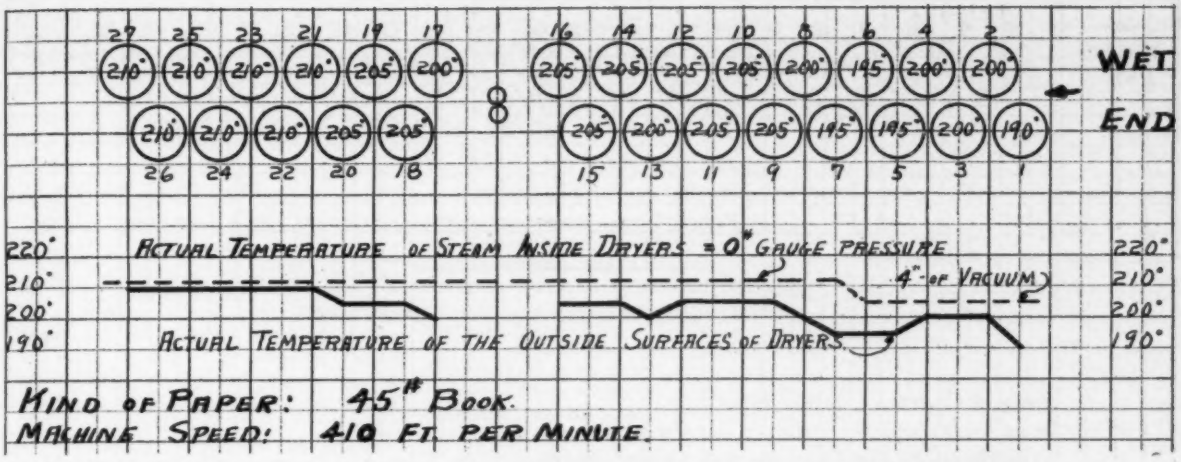
WET END
ACTUAL TEMPERATURE OF STEAM INSIDE DRYERS = 0" GAUGE PRESSURE
4" OF VACUUM
ACTUAL TEMPERATURE OF THE OUTSIDE SURFACES OF DRYERS
KIND OF PAPER: 45# BOOK.
MACHINE SPEED: 410 FT. PER MINUTE.

Fig. 3—Improved drying conditions on book machine with twenty-seven 60-in. diameter by 210-in. trim dryers

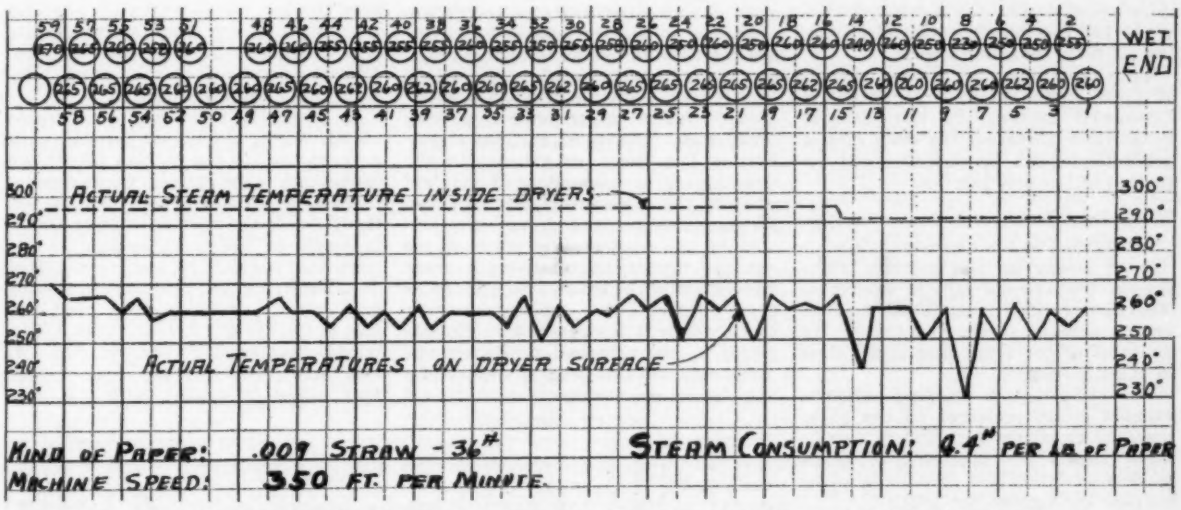
WET END
ACTUAL STEAM TEMPERATURE INSIDE DRYERS
ACTUAL TEMPERATURES ON DRYER SURFACE
KIND OF PAPER: .009 STRAW - 36#
MACHINE SPEED: 350 FT. PER MINUTE.
STEAM CONSUMPTION: 4.4# PER LB. OF PAPER

Fig. 4—Temperature chart of strawboard machine equipped with fifty-nine 42-in. diameter by 128-in. trim dryers showing detrimental effect of air and water

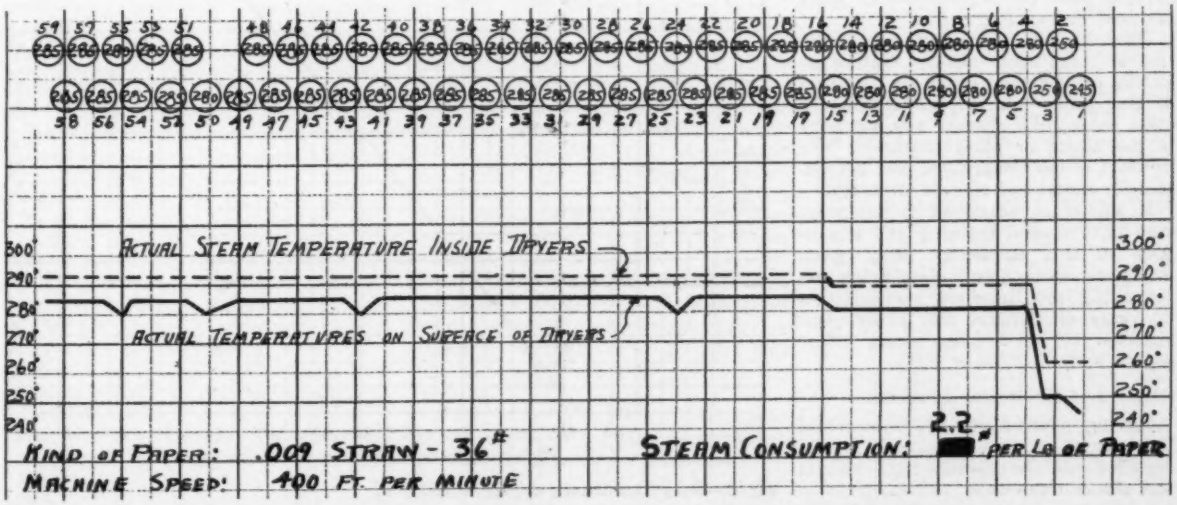
ACTUAL STEAM TEMPERATURE INSIDE DRYERS
ACTUAL TEMPERATURES ON SURFACE OF DRYERS
KIND OF PAPER: .009 STRAW - 36#
MACHINE SPEED: 400 FT. PER MINUTE
STEAM CONSUMPTION: 2.2# PER LB OF PAPER

Fig. 5—Temperature chart of same machine as in Fig. 4 after improper drying conditions were corrected

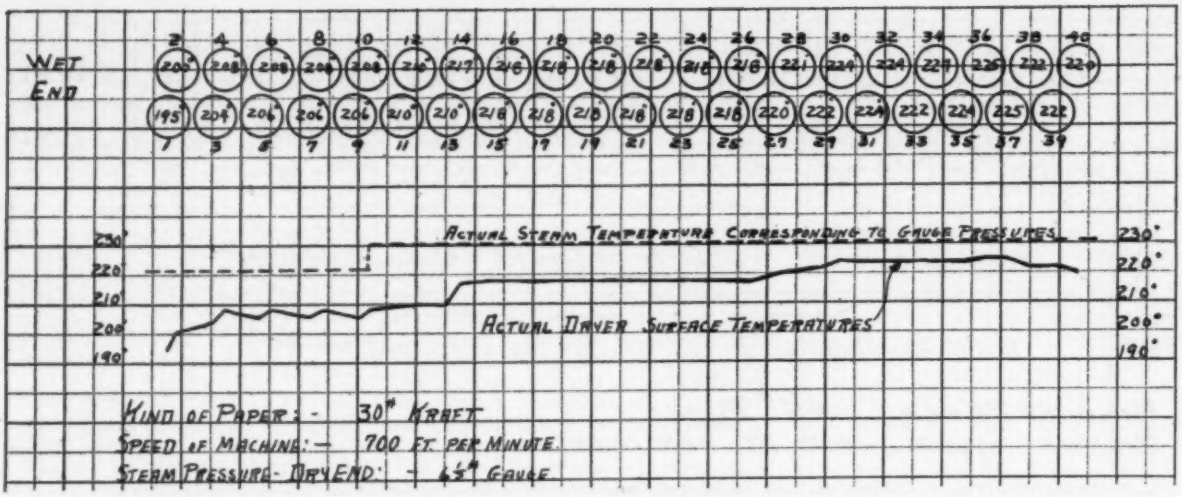
WET END
ACTUAL STEAM TEMPERATURE CORRESPONDING TO GAUGE PRESSURES
ACTUAL DRYER SURFACE TEMPERATURES
KIND OF PAPER:- 30# KRAFT
SPEED OF MACHINE:- 700 FT. PER MINUTE
STEAM PRESSURE- DRY END:- 45# GAUGE

Fig. 6—Temperature conditions on kraft machine with forty 60-in. diameter by 240-in. face dryers

chine speed or the steam consumption, by drying the sheet gradually, evenly, and at lower temperatures.

Quite often also, the accomplishment of these three results will permit a substantial increase in the machine speed, thus increasing the daily rate of production, with a corresponding reduction of the cost per ton.

Waste Heat Losses

In addition to the excessive consumption of steam on the paper machine proper, the average mill is subject to other losses directly attributable to improper general steam distribution, or to losses of the remaining heat values in the condensate.

The necessity for carrying excessive exhaust steam pressures on the paper machine to obtain satisfactory drying, often affects the operation of prime movers adversely and upsets the steam balance throughout the mill.

The importance of waste heat recovery is regarded far too lightly in many mills. It is believed that this attitude is not so much one of indifference, but a failure to appreciate the significance of some of these preventable losses.

After all, the determination and solution of these many adverse factors affecting drying costs is not the function of the paper mill superintendent, or even, except in a general way, the duty of the steam or plant engineer. The problem is too complicated and specialized for casual and routine attention.

It should be entrusted to engineers who have special training and experience in this particular field. Such engineers are capable of simplifying and correcting the inherited accumulation of years of changes and experiment, reflected in the average steam distribution system of paper mills.

Solution of the Drying Problem

Having pointed out the causes and detrimental effects of improper drying, together with the essential requirements for eliminating these factors, it is to be expected that a logical solution of such drying problems can be shown.

As has been stated, the old practice of permitting the steam to blow through the dryers unrestricted, was highly effective but far too expensive a procedure to follow under today's existing conditions. Therefore, instead of permitting the steam to exhaust to the atmosphere, a method was devised whereby the unrestricted flow of steam through the dry end dryers was created by the condensating effect of the wet end dryers, thus causing a rapid circulation of the steam into and out of every dryer. This induced velocity carries with it the air and condensate which is thus extracted constantly and completely *without loss of steam.* By duplicating the effectiveness of the old blow through method, plus the addition of proper control devices, the accomplishment of correct drying, under all conditions, regardless of the steam pressures used, has been insured.

By producing a continuous and rapid circulation of the steam through each dryer in the dry end portion, all air and condensate is evacuated. Consequently, there is a maximum heat transfer entirely across the surface of every dryer. It should be clearly understood at this point that there is no problem involved in attempting to produce reasonably good drying conditions in a great portion of the dry end dryers. Most drying troubles originate at the wet end. At this point, the wet and tender sheet first comes in contact with the heat,

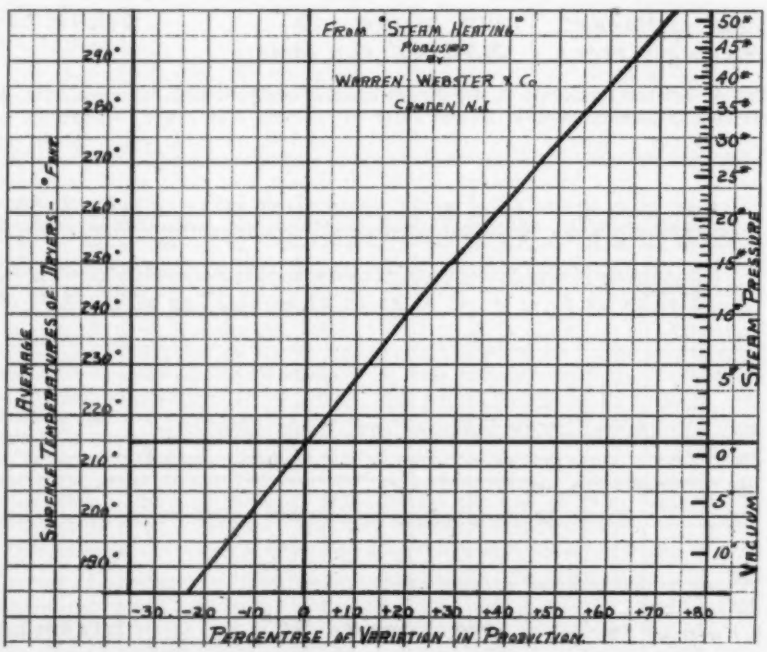
FROM "STEAM HEATING" PUBLISHED BY WARREN WEBSTER & CO CAMDEN N.J.
AVERAGE SURFACE TEMPERATURES OF DRYERS - °FAHR.
STEAM PRESSURE
VACUUM
PERCENTAGE OF VARIATION IN PRODUCTION

Fig. 7—Graph indicating drying capacity in relation to surface temperature

which must be applied evenly and gradually, and be of the proper initial temperature within certain reasonable limits, to insure freedom from the many causes of improper drying.

The wet end dryers perform by far the greatest amount of work, and most of the steam used on the paper machine is condensed in this part of the dryer section. These dryers, therefore, are subject to the greatest variation in temperatures, due to the presence of large quantities of air and condensate. This is clearly proved by taking temperature readings of the dryer surfaces on machines not properly provided with a drainage system. It will be found that, while the dry end dryers remain fairly constant, the temperatures on the wet end dryers will vary as much as thirty degrees during half hour periods.

In this respect, the correct drainage system not only removes all the air and condensate from the wet end and dry end portions at a steady rate, thus producing uniform drying conditions and a correct graduated temperature curve, but also returns the condensate to the boiler room at the highest possible temperature. Where essential, the condensate can also be freed of the excess air and inert gases, so detrimental to boiler operating conditions.

Due to poor heat transference, many machines are incapable of increasing their machine speed, because of low back pressures. By eliminating the air and water, the surface temperatures could be increased materially, as indicated by Fig. 4 and Fig. 5, without increasing the back pressures.

The chart illustrated in Fig. 7 shows what percentage of increase in the drying capacity would result from increasing the surface temperatures of the dryers. For example:

If we have a paper machine which shows that the average surface temperature of the dryers is 240 degrees Fahrenheit, how much increased production could be expected with the same back pressure, if the average surface temperature was raised to 260 degrees, all other factors such as moisture content, etc., remaining as before? Starting at 240 degrees on the left hand scale, move horizontally to slanting line, drop down vertically and read plus 20. Then follow the same procedure, starting at 260 degrees, and get plus 37.5 at the bottom of the chart. The difference between plus 20 and plus 37.5 equals 17½ per cent increased production.

To determine the increased production, as a result of increasing the back pressure, use the right hand scale in the same manner as explained above. With this scale, the results will only apply on machines where the air and water is being removed from the dryers constantly and completely.

In conclusion, if should be emphasized that no change in existing methods of drainage should be made without a thorough and careful analysis of all conditions pertaining to the use and distribution of the steam, and the return of the condensate to the boiler house. Each mill and each paper machine presents a separate and distinct problem, the solution of which depends upon the proper drainage system to meet the situation to the fullest extent.

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◆ Interesting Features Planned for Superintendents Meeting

Pulp and Paper makers throughout the United States and Canada are making arrangements to attend the Fifteenth Annual Convention of the American Pulp and Paper Mill Superintendents Association at the Poland Spring House, South Poland, Maine, on June 20, 21 and 22, 1934.

"Kil" Terry, General Convention Chairman, is elated with the progress that has been made for the general convention program and with the constantly increasing number of reservations received.

More details of the Poland Spring Program are now available and within a short time the complete and official program will be dispatched to all members and will be printed in the trade papers.

Starting a day ahead in order to greet the early arrivals on Tuesday, June 19, there will be an informal reception and get-together at Poland Spring House in the evening, followed by the showing of moving pictures and a talk on "Fishing and Hunting in Maine" by State Warden Joseph Stickney.

Wednesday, June 20, is Sport Day and during the daylight hours there will be all sorts of outdoor events for both the men and the ladies, including golf, bowling on the green, croquet, swimming, fishing, barn yard golf and tennis. At noon the ladies will have a gypsy luncheon on the shore of the lake. The men's luncheon will be in the Poland Spring House. At this luncheon Neal O'Hara, famous Boston newspaper columnist, sports writer and humorist, will be the speaker.

The Championship Golf Tournament will be held on Wednesday afternoon, the superintendents competing for the Eastwood Cup.

On Wednesday evening the ladies will dine at the Mansion House while the men hold forth in their Sports Jamboree at the Poland Spring House. For the ladies entertainment will be furnished by Larry Grey, demon humorist, monologist and playing card manipulator, and Leonard Crasks who will give an illustrated lecture showing brilliant color photography of scenes on the New England Coast and in some rare flower gardens.

Larry Grey will assist "Cy" Stewart, Chairman of the Sports Committee, as Master of Ceremonies in staging the numerous, laugh-provoking stunts that will feature the evening's program for the men.

A special string orchestra, with a lady soloist and a singing leader, will be at the ladies' party while the regular Poland Spring Orchestra will be at the men's meeting.

On Thursday morning the official program of the Convention will open with the presentation of three papers. Dr. Charles H. Herty will speak on "News Print From Southern Pine." Dr. Herty is especially noted throughout the paper industry for remarkable research work at his Savannah, Georgia, laboratory on the pulp qualities of Southern pine woods. He will be followed by George Carter, Director of the Government Printing Office, Washington, D. C., who will speak on "Uses of Paper, Standardization and Physical Tests." A paper on "Improvement in Paper Machinery during 1933-1934 will conclude the morning session.

At noon on Thursday there will be a joint luncheon in the Poland Spring House, with the Rev. John Nichol Mark, of Boston, Mass., as guest speaker. The Rev. Mr. Mark is noted for his timely Scotch wit and humor.

On Thursday afternoon the Group Meetings will be in session, with each group in the Soda and Sulphate, Board, Book and Fine Papers, Tissue, Sulphite and Ground Wood Sections applying themselves to their respective problems and discussions. Those interested in these group meetings are invited to send immediately to K. E. Terry, Cumberland Mills, Maine, any problem they wish to have placed before the desired group for discussion.

At about five o'clock on Thursday afternoon, on the spacious, green lawn of the Poland Spring House the Emerson-Mason Dancers, an attractive company of twelve girls, will present a special program of group and aesthetic dancing.

On Thursday evening there will be a joint dinner at the Poland Spring House, at which a nationally famous speaker will address the members and guests. After the dinner there will be a Costume Ball and between dances the Emerson-Mason Dancers will entertain with specialty features. For those who do not come prepared for the Costume Ball, but who wish to compete for the special prize for the best and funniest costumes, there will be a well stocked and efficient costumer on hand.

The general business sessions will be resumed on Friday morning and continue on Friday afternoon, which will include election of National officers. During the sessions on Friday papers will be presented on "Printing," "Standard Brightness Tester" and "Some Economic Considerations in Selection of Paper Mill Drives."

The joint noon luncheon on Friday will hear an address by President Clifton D. Gray, of Bates College.

At five o'clock on Friday, a program of aquatic sports will be presented on the lake. This will consist of log rolling and stunts by Alfred Landry and his crew of French-Canadian experts, and fancy diving by a team of two ladies, two men and a young boy. There will also be canoe tipping contests and sculling races.

The main banquet on Friday evening will be held at Poland Spring House, with President Herbert T. Randall presiding. The toastmaster will be Judge

Benjamin Cleaves, head of the Associated Industries of the State of Maine. The guest speaker on this occasion is a man of international fame, a vigorous, forceful talker. For the present his name is withheld, but before many days even this secret will be out.

Governor Brann, of Maine, is expected to attend the Convention on either Thursday or Friday.

The Convention Ball will follow the banquet.

The Convention program contains many additional features of a surprise nature. In addition to the foregoing events slated for the ladies, there will be, of course, a special Ladies Program which includes a bridge tournament for splendid prizes.

All queries regarding hotel reservations, exhibition space, transportation, golf and other sports will be cheerfully and promptly answered by George W. Craigie, Executive Secretary, Box 36, Cumberland Mills, Maine.

◆ DAVID ADAMS has been appointed Pittsburgh District Sales Manager of The Falk Corporation, Milwaukee, Wis., succeeding W. O. Beyer, who recently resigned. Mr. Adams has been with the Falk Corporation for the past four years in the sales department at Milwaukee. Mr. Adams' office will be in the Grand Building.

◆ BERTRAND HOPPER, founder and president of the Hopper Paper Company, Taylorville, Ill., passed away March 20. Mr. Hopper was 63 years of age.

◆ THE AMTHOR Testing Instrument Co., manufacturer of speed recorders and testing instruments for paper, cordage and light metals, has moved from 309 Johnson St. to 4-10 Leo Place, Brooklyn. The new plant combines office, showroom and factory on one entire floor and provides more complete facilities for increased business.

◆ David L. Luke

David L. Luke, President of the West Virginia Pulp and Paper Company for the past twelve years, passed away suddenly April 21, at the Savoy-Plaza Hotel in New York City.

A large delegation of prominent paper manufacturers attended the funeral services which were held April 24 at the family residence, "Hawthorne," Tarrytown, New York.

Mr. Luke was born at Rockland, Dela. 69 years ago. Following his graduation from the University of Pennsylvania in 1885, he immediately entered the pulp and paper business with which he has been identified ever since. He was one of the founders of the West Virginia Pulp and Paper Company and succeeded to the presidency twelve years ago upon the death of his brother, the late John G. Luke. At the time the company was formed, Mr. Luke occupied the offices of secretary and treasurer, later becoming vice president.

Surviving the deceased are his widow, seven children, seven grandchildren, three brothers and a sister.

◆ Nickerson Now Offers Engineering Service

Arno W. Nickerson, well-known T.A.P.P.I. member, is now located at 501 Fifth Avenue, New York, where he has established himself in business as a consulting and chemical engineer.

Mr. Nickerson secured his technical training at the University of Main and for the entire period of 18 years since his graduation he has been engaged in special work in the pulp and paper industry. He is president of the University of Maine alumni group of the pulp and paper industry, and has served as general chairman of the Converting and Consuming Division of the Technical Association of the Pulp and Paper Industry.

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◆ New Catalogues and Publications

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin No. 1165 illustrates and describes the company's line of bracket bearing synchronous motors. In addition to the standard line of motors for general requirements, including exciters, control equipment, etc., the bulletin also treats motors with special features of construction, such as anti-friction bearings, enclosed collector rings, splash-proof type, enclosed fan-cooled type and vertical motors. There is also a discussion of use of the synchronous motor for improvement of power factor with examples applying the graphical method for figuring power factor corrections.

Bakelite Corporation, Bound Brook, N. J.—A new 48-page booklet entitled "Bakelite Molded" has just been received. This booklet deals with the subject of Bakelite Molding materials and their uses, and gives a brief description of the molding process and needed equipment. The material is very concise and is enhanced with a large number of attractive halftone illustrations. Copies upon request.

Brown Instrument Co., Philadelphia—The Brown Resistance Thermometers for measuring temperatures from 300 deg. Fahr. below zero to 1000 deg. Fahr. above, are featured in a new 32-page catalogue just published. These thermometers are available in indicating, recording and controlling types and are said to have many new and improved features, such as: universal case, electric chart drive, combination door handle and lock, toggle switch for chart drive, that are standard with extra cost. For copies, request catalogue No. 9001.

Falk Corporation, Milwaukee, Wis.—A new folder describing the Falk-Rawson 4-Duty Coupling is now available. This folder contains new dimensions and also considerably lowered prices.

General Electric Co., Schenectady, N. Y.—Among the new literature recently issued by this company are: A booklet entitled "Improving Power-Factor for Profit," and another on the subject of "Electric Heating Units and Devices."

Howard Paper Company, Urbana, Ohio—This company sends out a portfolio of paper samples annually which is always a work of art. The 1934 portfolio is quite in line, both in quality and artistry, with the standard of Howard papers.

Johns-Manville, New York, N. Y.—A lecture entitled "High Temperature Insulation" prepared by this company's engineering department and used each year by schools of mechanical, chemical, metallurgical and ceramic engineering throughout the country, has been published in the form of a 32-page pamphlet and is available to those interested in the subject. The lecture comprises a short review of the principles of heat transfers; a discussion of the theory and practice of insulation as applied to industry; charts and graphs on the conductivity values of insulation and refractories; insulation in boilers, kilns, oil stills, furnaces, regenerators and other typical industrial equipment operated at high temperatures. A standard formula for heat transfer by conduction and description of a method of determining heat flow through furnace walls are also included. Another publication is a brochure on Johns-Manville Transite Pressure Pipe.

Link-Belt Company, Chicago—This company has issued a new general catalogue with list prices effective as of April 1st. The complete line of equipment manufactured is covered in the catalogue, and in the foreword, the book is referred to as a handbook of practical information on Link-Belt cost-reducing machinery.

Peninsular Paper Co., Ypsilanti, Mich.—A unique advertising campaign has been initiated by this company, which seems to be a departure from that usually used by paper mills. The first piece of literature used in this campaign is "Starting from Scratch," in which the purpose of the campaign is set forth. The points brought out are forceful and typical of the New Deal in business. The second of the series is an attractive brochure giving a line-up of the company's personnel, information on its line of cover papers and other general data.

Pfaltz & Bauer, Inc., 300 Pearl St., New York—Gruebler-Holiborn Stains and Preparations for Microscopy is a 14-page listing including the "Bayer-Meister-Lucius" standardized and certified stains, new multiple stain combinations and stains for special purposes, such as textile tests, the detection of gasoline in arson, etc. Copies on request.

Quigley Company, New York, N. Y.—Q-Chrome Super-Refractory Cement is the subject of Bulletin No. 306. A concise description and applications of this product are given in the bulletin and the manufacturer will furnish complete details upon request.

Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.—A new bulletin describes briefly the characteristics of Westinghouse synchronous motor drives and control for paper mills, and the advantages claimed for these motor drives. In the publication are shown definite types of synchronous motors with torque characteristics particularly fitted to specific applications. Copies on request.

BOOKS

Directory of Paper Makers of Great Britain & Ireland. The 1934 edition of this directory has been thoroughly and authentically revised and brought up to date in all its various sections. Many new additions have been made in the trade designations, also numerous withdrawals and transfers of names in both actual watermarks and trade names which makes the book valuable to printers and stationers, and paper buyers generally. The special article "The Past Year in the Paper Trade gives a resumé of the effects of the tariffs which have been in force and there is also a list in detail of the customs duties affecting the paper trade. There are the usual alphabetical lists of merchants, dealers and producers. The publisher, Marchant Singer & Co., 15 Nicholas Lane, London, E. C. 4, will supply copies at price of 5/6 nett, post free in U. K., Abroad 5/-.

The Finnish Woodpulp and Board Union has issued an exceptionally fine souvenir book commemorating its fortieth anniversary. There is a short description of the origin and development of the Finnish Woodpulp Industry, supplemented by chapters each devoted to the concerns affiliated with the union in so far as they manufacture mechanical woodpulp and cardboard. The book is attractively laid out and printed and is illustrated with a large number of photographs and splendid scenic halftones.

◆ Self-Cleaning Water Strainer

A new water strainer, which embodies in its design a backwashing feature by means of which the strainer is cleaned while in operation, is being manufactured by Freyn Engineering Company, 310 South Michigan avenue, Chicago. The strainer, designated as the Phillips strainer, comprises two baskets placed at 90 degree angles to each other, and through which the flow of water is controlled by two swinging gate valves.

The strainer baskets, each of which is a perforated cylinder with ⅛ to ⅜-inch or larger perforations as desired, are made of brass with bronze rings at top and bottom. The strainer housing is made of cast iron for water pressures below 125 lb. per sq. in. and in cast steel up to pressures of 200 lb. per sq. in.

The swinging gate valves consist of a bronze disc which is held against a bronze seat by the line pressure of the water. The disc is carried on a stainless steel shaft which is held in live rubber bushings permitting the shaft to shift its center to allow the swinging gate to seat perfectly.

Under normal operation, both gate valves are open. Water enters at the bottom and divides, half passing through each strainer basket. To clean one of the baskets, the bottom gate valve is closed, cutting off the inlet water to that basket. The by-pass valve on that basket is then opened, with the result that clean water from the discharge of the other strainer basket is forced through the first mentioned strainer basket in the reverse direction, flushing the dirt out of the baskets and through the by-pass valve. The by-pass valve is then closed and the gate opened.

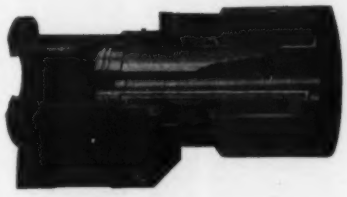
To remove a strainer basket for inspection, both gate valves are closed, whereupon the basket may be removed the same as with the conventional type of twin basket strainer.

In making an installation a strainer may be mounted in any position—horizontal, vertical, on its side, or upside down.

◆ Expansion Joint

A new design of slip type expansion joint is being manufactured by the American District Steam Co. of North Tonawanda, N. Y. In this design of joint, two piston rings are mounted in a piston head securely attached to the inner end of the slip. Back of the piston head in the body is a relief chamber which is vented by piping leading away from the expansion joint. When it is necessary to repack the joint, a valve in the vent piping is opened and the pressure between the piston head and the stuffing box is relieved.

When the joint is in operation, pressure is built up in the relief chamber. With the vent open this pressure is immediately relieved and such little steam



as may pass the piston rings immediately expands, and is discharged through the vent without reaching the stuffing box area. Thus, the joint can be completely repacked without interruption to service.

The piston head in which the piston rings are retained also serves as an internal guide operating in the machined cylinder of the body, thus preventing any lateral distortion of the slip, and the stop ring prevents the slip from being pulled out of the body.

The new piston ring expansion joint is now being placed on the market for all operating pressures and in all pipe sizes.

◆ Chain Grate Stoker Redesigned

In order to provide for fixed attachment of controls, a frame construction capable of coping with expansion, and simple conversion to forced draft if desired, Combustion Engineering Company has substantially modified the design of its Green Natural Draft Chain Grate Stoker. Instead of a castiron frame supported on wheels, as formerly employed, the new design, designated as the "KS," has a stationary structure, fixed into the setting. This consists of

transverse channels supported on posts at either side, to which, in turn are fastened angles parallel to the side walls; skids supported on I-beams carry the weight of the chain at the bottom. A pipe, flush with the side wall, and extending nearly the length of the stoker, carries the adjusting rod and takes the tension off the frame. While the take-up in the tension of the chain is at the rear, the actual adjustment is at the front which is always accessible.

With natural draft, zone control may be applied, if desired, by placing louvre dampers between the channels in one or more compartments. Where conditions make it desirable to change to forced draft, this can readily be accomplished by substituting forced draft links, adding dampers and installing an internal seal and hood at the front.

A water-cooled rear shaft such as is used on the forced draft type is optional with this design.

◆ Pyrometer for Measuring Surface Temperatures

A pyrometer, known as Alnor Pyroll, has been announced by the Illinois Testing Laboratories, Inc., 141 W. Austin avenue, Chicago. This pyrometer has been developed to permit measurement of temperatures of revolving or curved surfaces and a single application in the paper field that is suggested is that of paper machine dryers.

This instrument is self-contained. Its indicator is mounted in a housing to which is attached a supporting arm which also holds a ribbon type thermo-couple. The indicator consists of a millivoltmeter having a case diameter of 4½ inches, a scale length of 3½ inches, and a scale graduation of either 0-600, 0-800 or 0-1000 degrees Fahr. The standard length of the supporting arm is 24 inches, but other lengths shorter or longer up to 48 inches can be furnished. The thermo-couple consists of a flat strip type wire held in a bow-shaped assembly to which is attached a grooved block that allows only a definite amount of tension to be applied to the thermo-couple. The thermo-couple is connected to the instrument by extension wires extending through the inside of the supporting arm. The instrument is also furnished with an internal automatic cold end compensator to compensate for atmospheric or room temperature variations.

◆ Leather Belt Development

A new type of leather belt, known as Monobelt, has recently been developed by Alexander Brothers, 406 North Third Street, Philadelphia, Pa. Specially prepared vegetable tanned leather having a high adhesion and thoroughly stretched by a special process is used in its construction. Leather with very minimum of stretch is used in single ply belts; while in double ply belts, the pulley side of the belt is made of the same leather

as the single ply, but the outer ply is made of more elastic leather. While the belt is made waterproof and is tested when finished on a special running-in machine, other improvements are said to be included in the manufacture of the leather with a view to securing a material possessing unusually high qualities for the transmission of power.

This belt is made in only one standard thickness for each width, thickness increasing with width, on the principle that narrow belts are generally used on small diameter pulleys where a thin belt is usually proper and wider belts on larger diameter pulleys where a heavier belt is in order.

◆ Variable Speed Transmission

A self-adjusting, positive variable speed transmission for fractional horsepower duty, known as the Link-Belt V.R.D. (Variable Roller Drive), is being announced by Link-Belt Company, Chicago, as a companion to its P.I.V. Gear variable speed transmission announced about five years ago for larger capacities.

The V.R.D., which is capable of a horsepower output of ½ h.p. at maximum speed, with a maximum ratio of

speed variation of 10 to 1, continues such features as compact all-metal construction; total enclosure; self-lubrication in an oil bath; protection from moisture and grit; and the use of a chain for transmitting the power positively.

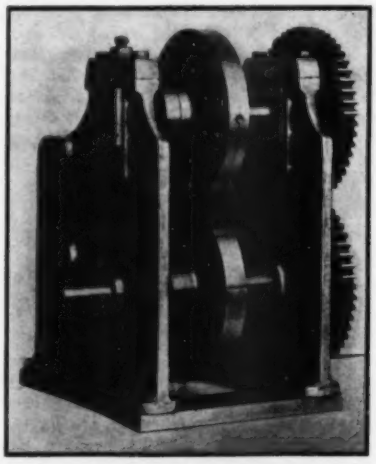
Novelty in the V.R.D. consists in the construction and application of the chain which is used for transmitting the power from input to output shaft. It is side-contact roller chain, consisting of steel links, made endless and connected by hardened steel pins in hardened steel joint bushings.

A speed indicator permits ready check-up on operating speed settings. Spring pressure applied to the two discs of one wheel serves to maintain correct tension and compensate for natural chain wear automatically.

The V.R.D. is furnished with horizontal or vertical box; with or without reduction gearing; and can also be supplied motorized; with motor forming an integral part of the unit.

◆ Paper Punching Machine

A rotary punching machine for punching holes in a strip of moving paper has been introduced by the Whitmore Machine and Foundry Company of Menasha, Wis. This machine suggested for attachment to disc ruling machines, rotary printing presses, or other machines where holes in a continuous web might be desired, can be made to fit any size or width of machine. It will also punch holes of any size or shape spaced as desired, in any number of rows, the



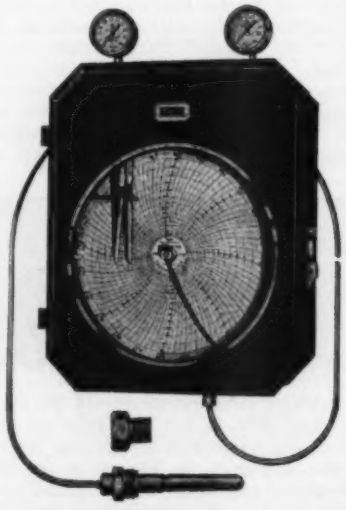
speed of the punch being limited only by the speed of the equipment to which it is attached.

The punching is done on a retracting tape which is claimed to eliminate all punching troubles.

A miniature model of the machine is illustrated.

◆ Newly Designed Recording Regulator

A new line of air-operated recording regulators, known as Taylor Fulscope, has been announced by Taylor Instrument Companies, Rochester, N. Y. In this line of instruments is incorporated a sensitivity adjuster for balancing the



regulator performance against the time lag in the apparatus under control. The regulator mechanism and means of adjustment are the same in all instruments whether for controlling temperature, pressure, rate of flow, or liquid level. They differ only in their means of actuation.

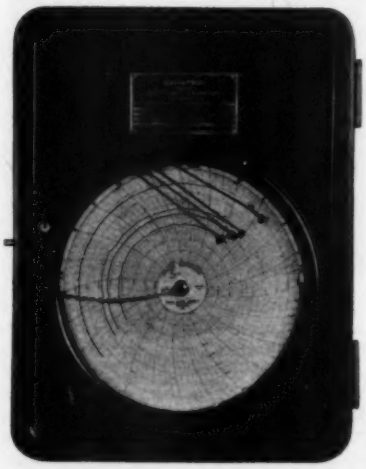
Control is maintained in the conventional manner by regulating the flow of air pressure to the diaphragm valve in the controlling medium line in response to changes in apparatus under control. A constant 25-lb. air pressure supply for actuating the diaphragm valve is recommended. However, should the pressure occasionally rise or fall below the recommended figure, a novel and dependable compensating device maintains the desired control until normal pressure is restored.

A higher degree of accuracy than hitherto possible is said to be produced by a new lightweight duralumin mechanism, practically frictionless bearings, and other simplifications and refinements of design.

The case for the regulator is of die-cast aluminum and is supplied for either face or flush mounting. A Warren Telechron electric-chart-driving mechanism is standard equipment; and a spring-driven mechanism optional.

◆ New Potentiometer Pyrometer

Bailey Meter Company of Cleveland, Ohio has developed a new potentiometer pyrometer which has been named Galvatron. One Galvatron may include as many as four potentiometer circuits, the



contact making galvanometer being automatically switched from one circuit to the next by relays actuated from contacts made by a synchronous motor driven time device.

An outstanding feature claimed for the Bailey Galvatron is its continuous record or records, up to four in number, made on a circular recording chart. When more than one record is provided for, each is made in a different color of ink so that it can be distinguished from the others on the chart, regardless of how many times they cross each other. In the case of a multi-pen Galvatron recorder, all records are continuous, although the contacts made by the galvanometer needle are divided among the potentiometers. In the case of a one-pen recorder, all contacts made by the galvanometer serve to adjust the potentiometer, which in this case is adjusted

every four seconds if necessary. In the case of a four pen recorder, each potentiometer receives a contact every 16 seconds, so that each record is a smooth continuous picture of existing conditions.

◆ High Tensile Strength Electrode

An electrode designed especially for use on high tensile steels has just been announced by The Lincoln Electric Company, Cleveland, Ohio. It is a heavily coated electrode of the shielded arc type and is said to be particularly suitable for the welding of low alloy structural steels which, on normalizing, have tensile strengths under 100,000 lb. per sq. in.

This electrode, suitable for flat, vertical and overhead welding, is available in 5/32-in. and 3/16-in. sizes. For most vertical and overhead welding, the 5/32-in. size is preferred; however, for vertical welds in thick plate, 3/16-in. may be used.

◆ Bearing Bronze Development

A new form of bearing bronze of particular interest to maintenance engineers is the semi-finish (outside and inside) Magnolia bearing bronze bar stock made by the Magnolia Metal Company, of Elizabeth, N. J., manufacturer of anti-friction babbitt. This bronze is furnished in standard 12-in., 13-in. and 14-in. lengths, from ½ in. solid up to 5 in. outside diameter; cores up to 2½-inch inside diameter.

Literature covering this product has been prepared for distribution by the manufacturer.

◆ Self-Supporting Panels for Small Circuit Breakers

Self-supporting steel panels for mounting small oil circuit breakers for isolated installations have been announced by the General Electric Company, Schenectady, N. Y.

The new equipment consists of an isolated flanged steel panel, to which supporting feet have been welded, so that the panel when fastened to the floor becomes a self-supporting structure. In addition to the breaker and its operating lever, accessory apparatus such as current transformers, relays, etc., can be mounted on the panel. If desired, a metal guard can be obtained to enclose the back of the equipment from the top of the breaker tank to the top of the panel.

The equipment is suitable for use on ungrounded systems up to 2,500 volts. The oil circuit breaker interrupting ratings are 20,000 to 50,000 kv-a.

◆ Kennedy Valve Line Increased

A new line of heavy standard bronze globe and angle valves, known as Kennedy Fig. 89 Globe Valve and Fig. 90 Angle Valve, is now being offered by The Kennedy Valve Manufacturing Company, Elmira, N. Y. In these valves, which are of union bonnet ring construction, both the malleable iron union bonnet rings and stuffing box nuts are cadmium plated; bearing surfaces between valve stems and discs are specially designed to reduce operating effort; and four guide prongs are used on the disc holders to prevent their tipping or binding.

Among other features pointed out in the announcement of these valves are the interchangeability of all operating parts of both globe and angle valves of the same size, the special molded self-lubricating packing; the unusually high raised seats in the bodies, and the possible repacking under pressure.

Additional information on these valves may be obtained by addressing the manufacturer.

◆ Color Matching Device

A self contained portable color-matching device, known as Telecolor, has been developed by the Hays Laboratories, Pawtucket, R. I. The instrument uses photo electric cells for the purpose of distinguishing differences between any two specimens, indicating which of the two is the lighter in shade, when placed in respective compartments and the resultant difference read on a calibrated dial in percentage difference. It

is then possible to place each specimen in the device separately and with the aid of six color filters, read the values of each of the primary and secondary colors composing the total color. In addition to the above functions, its use in the paper industry as an opacimeter has proved to be very helpful. Any difference in finish on paper can readily be detected.

To make it portable, the size has been confined to approximately 14 x 14 x 7 inches and the weight to 15 pounds. It operates from any electric light socket.

◆ Automatic Manometer-Regulator

A new type of manometer fitted with automatic electric control features is now being manufactured by The Meriam Co., 1955 West 112th street, Cleveland, Ohio. The new instrument is stated to be unusually rugged and simple and to remain permanently accurate under severest service conditions. It is said to be adaptable to a wide variety of direct and differential control uses for pumps, liquid levels in tanks and sprinkler systems, and for maintaining gas pressure and flow between close limits; or for starting and stopping the flow in two pipes alternately for special purposes.

Other uses suggested are the automatic starting of a reserve pump in case of a failure of the regular unit to operate, the production of alternate pressure and vacuum in a closed vessel, or for electrically operated remote control of steam valves, etc. It has the additional advantage of providing a visible reading of performance at all times.

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◆ Andreas Christensen Leaves Rhinelander

Andreas Christensen, for twelve and a half years superintendent of the sulphite department of the Rhinelander Paper Company, Rhinelander, Wis., resigned his position effective April 1st.

Mr. Christensen has accepted a position in a similar capacity with the Grays Harbor Pulp & Paper Co., of Hoquiam, Wash. For four years prior to coming to Rhinelander, Mr. Christensen was connected with the Whalen Pulp & Paper Mills, of Vancouver, B. C., and Pacific Mills Limited, of Ocean Falls, B. C., as superintendent of sulphite mills.

Sigge Ekman, chief chemist, is taking over Mr. Christensen's duties at Rhinelander. No successor for Mr. Ekman has been named.

◆ JOSEPH PARKER & Son Co., New Haven, Conn., manufacturer of fine blotting papers, announces the opening of a Chicago warehouse at 417 West Harrison Street. The Chicago office under the direction of George B. Tapner will remain at 77 West Washington Street. Ample stocks will be carried in this warehouse to serve not only the Chicago area, but the entire Middle West.

◆ ALFRED J. JUPP, a vice president of the Lunkenheimer Company, Cincinnati, Ohio passed away suddenly in New York City April 10 while on a business trip. Mr. Jupp was 59 years of age, and had been with the Lunkenheimer Company for 44 years.

◆ Alex. G. Gilman Resigns

Alex. G. Gilman, president of the Allied Paper Mills, Inc., Kalamazoo, Mich., has resigned as the company's chief executive, which office he has held since 1922. Beyond stating that he will take a vacation and rest, Mr. Gilman has made no announcement as to his future plans.

Mr. Gilman has been active during the past year as a member of the national executive committee of the Book Paper Manufacturers Association. He has functioned as chairman of the Merchants contact committee and also as a director of the Sales to Publishers committee of the national association.

POWER

GENERATION + UTILIZATION + MAINTENANCE

This section turns the searchlight on power and its allied problems, showing big possibilities to save. Opportunities to improve conditions, methods, apparatus will be discovered. Worth while practices suggest new ideas and wider usages of equipment.

By W. S. JOULE

◆ Trouble-Free Boiler Operation

So much attention has been given to assure soft water for boilers that at least two other important trouble producing factors are often neglected. The first of these is the presence of insoluble solids which result in mud and scale and eventually lead to clogged, scaly tubes. The second is the soluble salts which may be present, despite water softening treatment.

The first of these troubles is overcome by deconcentration of the boiler water, by some system which causes the insoluble materials to precipitate to the bottom of a separate deconcentrator tank, where they may be drained off.

The second trouble, soluble salts, may be overcome by blowdown systems, the most efficient of which operate continuously and in conjunction with heat exchangers to minimize heat loss of blowdown.

Many waters, even softened waters, require a combination of deconcentration and blowdown treatment for best and most trouble-free operation.

◆ Inspect Generators Annually

It is desirable that a generator be given a systematic cleaning and overhauling at least once every year. Whether the machine apparently needs it or not, such a general overhauling will often reveal weak spots which might cause trouble later on.

The procedure employed in overhauling a machine will depend, of course, upon the size and type and upon the conditions under which the machine has been operating. The following instructions are only general and may be modified to suit conditions. They will serve, however, to give an idea of what should be done and what to look for.

To begin with, open all switches connecting the machine to the line and make certain that all parts are dead. Remove the bearing caps and mark the position of the brush rocker arm so as to insure correct return to neutral when re-assembling. Before removing the armature, check its position between the field poles to see whether the clearance is uniform. Remove bearing pedestal at the end opposite to the commutator and block up the armature so that when the bearing is removed it will not fall upon the field poles. Now, with a chain block and by properly slinging the armature, withdraw the latter from its position in the generator and place it between suitable supports so that it can be rotated and thoroughly inspected. Blow out all windings with compressed air and clean with gasoline.

Examine the commutator for loose bars or connections. If the shaft is roughened or cut, true it up before any bearing sleeves are repaired. Have bearings scraped or rebabbited, if necessary.

See that all field poles are securely fastened to the frame yoke, and, if any are found loose, tighten them. Armature as well as field coils and all leads may be painted with insulating varnish, if desired. Do not paint pole shoes nor the armature core disks as this might result in insufficient clearance between these two parts and cause the armature to freeze between the poles if shut down for any length of time. Before painting, examine armature and field windings for places where the insulation has cracked or peeled off and use tape and shellac to repair such faulty spots.

Examine armature band wires for tightness and slip mica under them, if loose.

Clean the brushes one set at a time to avoid mixing them up and replace worn ones with new ones. Renew weak springs and give all brushes the same tension. See that all pigtails are tight.

In re-assembling be sure to get the armature exactly in the center of the field poles by adjusting the bearings. If bearings have been rebabbitted, see that they are grooved for oiling and that all grit has been removed before replacing the bearing cap.

◆ Cleaning Heating Surfaces Systematically

When it has been fully realized just how important it is to have clean heat transmitting surfaces, at least a part of the battle for higher operating efficiencies has been won. This in itself is not sufficient, however, for even with the very latest and best types of cleaning equipment, it is important that the work be performed on some definitely scheduled basis which has been worked out according to existing conditions.

Soot should be blown at least every 24 hours, and in most plants it is customary to blow at least once during each 8 hour-shift. When the boilers are being forced at a high rating, it is necessary to blow more frequently. Some fuels are also worse than others in the amount of soot deposited, hence no definite rules can be laid down for the frequency of blowing. It is a matter which must be worked out individually.

If soot is allowed to accumulate for periods longer than 24 hours, it has been found that the fixed blower will not entirely remove the deposits. The time between cleanings should take this point into account, so one of the principal arguments for permanent blowers is that the boiler will not have to be taken off the line as often for a periodical cleaning. If the time between blowings is too long, it will be necessary to take the boiler out of service in order that the tubes may be scraped.

It is usually customary to blow the soot a short time before the boiler will be called on to meet a peak load. In small plants, it is frequently the custom to clean the fires just before the peak comes on and it is good practice to use the blowers just after this.

After a blowing schedule has been determined, it is important that the work be properly performed. This is true not only when the blowing is done with a hand lance, but also where it is done with fixed blowers. As soot is removed by the direct impact of the jet, it is quite evident if the jet is rotated too rapidly, thorough cleaning will not take place. On the other hand, if the operation proceeds too slowly more steam will be used than needed.

◆ Sound Indicates Spring Tension

In governing or changing the speed of a steam engine, care should be taken to adjust the governor springs so that the sounds, when they are tapped with a hammer, will be as nearly alike as it is possible to get them. If the sounds are different, it is a case of unequal tension, which will result in unequal strain and may cause racing.

◆ To Clean Brass Electrical Parts

When assembling electrical parts as magneto, generator or motor contacts, the pieces should be clean and bright to assure electrical conductivity. The use of a file, scratch brush or sandpaper, involves much time and patience with the result that the mechanic is more likely to assemble parts without cleaning, taking a chance that the work will be successful in operation.

A good method is to dip the parts into a bath consisting of a half pint sulphuric acid, half pint nitric acid and two tablespoonfuls of salt. The articles are dipped into this solution and immediately rinsed in water. The old corroded parts are made as bright as new and when assembled the worker is assured that the essential electrical contact is made in the parts of the mechanism.

Approved Pulp Testing Chemists

The following pulp testing chemists are approved by the American Paper and Pulp Association, the Association of American Wood Pulp Importers and the Technical Association of the Pulp and Paper Industry:

Commercial Chemists

Andrews, A. B., Box 67, Lewiston, Maine.
Broeman, F. C., Broeman Bldg., Cincinnati, Ohio.
Crossley, T. L., 71-73 Richmond Street, W., Toronto, Ont., Can.
Donald & Co., Ltd., J. T., 40-42 Belmont St., Montreal, Can.
Hamlin & Morrison, 216 So. Second St., Philadelphia, Pa.
Hanks, Inc., Abbot A., 624 Sacramento St., San Francisco, Calif.
Hersey Co., Milton, 980 St. Antoine St., Montreal, Can.
Hinman, Elmer S., N. Walnut St., Spring Grove, Pa.
Johnson, Emil F., 133 Front Street, New York City.
Knudsen, K. Hv., 82 Gold St., New York City.
Liepsner Laboratory, F. W., 309 Camp St., New Orleans, La.
Little, Inc., Arthur D., 30 Charles River Road, Cambridge, Mass.
Maas Chemical Laboratories, Arthur R., 308 E. Eighth St., Los Angeles, Calif.
Miles, George W., 88 Broad St., Boston, Mass.
New England Laboratories, 44 Chestnut St., Springfield, Mass.
Orthmann Laboratories, Inc., 647 W. Virginia St., Milwaukee, Wis.
Perry Testing Laboratory, 201 Third St., Detroit, Mich.
Ross, Lawrence Taylor, Hudson Falls, N. Y.
Schwantes, Everett J., 431 S. Dearborn St., Chicago.
Skinner & Sherman, Inc., 246 Stuart St., Boston, Mass.
Stillwell and Gladding, Inc., 80 West St., New York City.
Tiffany, Harold E., 321 Delaware Ave., Wilmington, Dela.
Touceda, Enrique, 943 Broadway, Albany, N. Y.
U. S. Testing Co., Inc., 1415 Park Ave., Hoboken, N. J.
Whittington, E. F., 530 West Cedar St., Kalamazoo, Mich.
Wiley & Co., Inc., Calvert & Road Sts., Baltimore, Md.
Williams, F. M., 600 Trust Co. Bldg., Watertown, N. Y.

Pulp and Paper Mill Chemists

Annis, Harold M., Allied Paper Mills, Kalamazoo, Mich.
Abrams, Allen, Marathon Paper Mills Co., Rothschild, Wis.
Arbo, Henning J., B. C. Pulp and Paper Co., Ltd., Vancouver, B. C., Can.
Bickell, Leslie K., British Columbia Pulp & Paper Co., Port Alice, B. C., Can.
Bradford, Harry C., Rex Paper Co., Kalamazoo, Mich.
Breitenbach, Wm. E., Grays Harbor Pulp & Paper Co., Hoquiam, Wash.
Calkin, John B., Baker Laboratory, Cornell University, Ithaca, N. Y.
Cannon, Harvey P., Container Corp. of America, Manayunk, Philadelphia, Pa.
Connor, C. N., Glassine Paper Co., W. Conshohocken, Pa.
Coster, N. W., Puget Sound Pulp & Timber Co., Everett, Wash.
Durand, Edgar Deagagne D., Consolidated Paper Corp., P. O. Box 45, Port Alfred, Que., Can.
Genberg, G. P., Fraser Companies, Ltd., Edmunston, N. B.
Hogan, J. Fenton, Carthage, N. Y.
Hunnemann, Jr., Arthur, Container Corp. of America, 111 W. Washington St., Chicago.
Kidder, W. K., Bryant Paper Co., Kalamazoo, Mich.
Koch, H. C., Auglaize Box Board Co., St. Marys, Ohio.
Libby, Frank D., Kalamazoo Vegetable Parchment Co., Kalamazoo, Mich.
Monnberg, Ragnar, Abitibi Power & Paper Co., Ltd., Smooth Rock Falls, Ont., Can.
Osborne, Wesley M., 1213 South Fife St., Tacoma, Wash.
Rammer, Hyman L., Fibreboard Products, Inc., Stockton, Calif.
Roberts, Denis, Port Royal Pulp & Paper Co., Ltd., Fairville, N. B., Can.
Steadman, B. K., Standard Paper Mfg. Co., Richmond, Va.
Wadsworth, Dan M., P. O. Box 704, Bogalusa, La.
Wells, Sidney D., Combined Locks Paper Co., Combined Locks, Wis.

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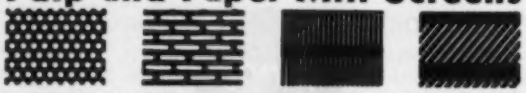

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SKANEATELES FALLS, N. Y.

The Paper Industry Safety Contest

July 1, 1933, to June 30, 1934

Scores as of March 31, 1934 (Cum.)

7 Mills Still in the Race

PERFECT SCORES

Division I—Paper and Pulp Mills

	PARTICIPANT	MILL	LOCATION
GROUP A			
GROUP B	St. Croix Paper Co.	Woodland	Maine
GROUP C			
GROUP D	Bird & Son, Inc.	Roofing Plant	Chicago
	International Paper Co.	Riley	Maine
	Hollingsworth & Whitney Co.	Abenaquis	Madison, Me.
	Spaulding Fibre Co., Inc.	Hayes	No. Rochester, N.H.

Division II—Remanufacturing

Container Corp. of America	Natick	Massachusetts
Southern Container Co.	Houston	Texas

IMPERFECT SCORES

	Key	Rank	Points Credit	Points Debit
GROUP A	PA- 6	1	868.842	
	PA- 2	2	810.400	
	PA-17	3	775.464	
	PA-11	4	690.278	
	PA- 5	5	638.770	
	PA- 1	6	635.872	
	PB- 5	7	585.078	
	PA- 8	8	515.962	
	PA- 4	9	480.458	
	PA- 3	10	440.934	
	PB- 2	11	223.524	
	PA-14	12	218.186	
	PA-12	13		94.672
	PA-15	14		149.736
	PA-13	15		156.544
	PA-16	16		346.776
	PA- 9	17		492.718
	PA- 7	18		893.482
GROUP B	PB- 9	2	891.746	
	PC-10	3	761.880	
	PB- 6	4	718.138	
	PB- 1	5	698.672	
	PB- 7	6	698.482	
	PB-15	7	691.862	
	PC- 7	8	578.842	
	PB- 3	9	514.712	
	PC- 9	10	419.638	
	PB-16	11	314.944	
	PB-11	12	301.792	
	PB-14	13	47.872	
	PB-13	14		85.382
	PB- 4	15		199.000
	PC- 2	16		303.894

DIVISION II

RD-4	5	783.282	
RD-1	6	667.950	
RC-5	7	650.120	
RD-5	8	636.370	
RD-6	9	452.108	
RC-4	10	405.658	
RC-2	11	358.486	
RC-3	12		39.134
RD-7	13		950.746
RD-3	14		1,377.622

	Key	Rank	Points Credit	Points Debit
GROUP C	PC- 6	1	913.240	
	PC-25	2	807.656	
	PC-22	3	730.354	
	PD-28	4	662.802	
	PB-10	5	534.174	
	PD-17	6	515.770	
	PC-11	7	502.242	
	PC-24	8	440.322	
	PD-25	9	370.504	
	PD-13	10	358.618	
	PB-17	11	331.174	
	PC-23	12	286.550	
	PC- 8	13	237.070	
	PC-18	14	214.890	
	PC- 4	15	125.534	
	PC-21	16	115.472	
	PC-16	17		85.478
	PD-14	18		137.112
	PC-12	19		140.278
	PC- 3	20		804.840
	PB-18	21		953.154
	PC-26	22		1,074.054
GROUP D	PD- 4	5	845.312	
	PD-15	6	806.182	
	PD- 1	7	738.434	
	PD-27	8	700.546	
	PD- 6	9	636.176	
	PD-26	10	564.032	
	PD- 9	11	538.528	
	PD-24	12	520.134	
	PD- 7	13	508.006	
	PC-20	14	495.634	
	PD- 3	15	441.026	
	PD-18	16	430.160	
	PD-20	17		216.272
	PC-13	18		222.570
	PD- 8	19		262.942
	PD-29	20		912.184
	PD- 2	21		1,320.570

No March Report: PC-14, PC-15, PC-19, PC-27.

Withdrawn: PA-10; PB-8, PB-12; PC-5, PC-17; PD-21, PD-22, PD-23; RA-1.

◆ Paper Mills Establish Good Record in Safety Contest

Thirty out of sixty-two paper mills and paper goods manufacturing plants in Michigan, Illinois, Minnesota, and Wisconsin established perfect records in a No-Accident Contest recently conducted by the Employers Mutuals Liability Insurance Company of Wausau, Wisconsin. The contest included 1,160 concerns representing 51 industries in the

A PENNY FOR SOME FOLKS' THOUGHTS IS A PENNY TOO MUCH

—Uncle Jake

This is particularly true for those in the paper industry who go around piously telling everybody else "it pays to advertise," but whose personal policy is to let George do it.

What are we thinking about!

Here we are, the one industry that stands to profit most by any increase in advertising appropriations—doing almost nothing about it.

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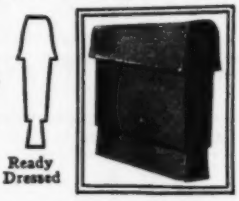

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THE PAPER INDUSTRY

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four states. Workers in paper mills and paper goods manufacturing plants competed in effort to reduce accidents in their plants for the seven month period beginning June 1, 1933, and ending December 31. The results of the contest are indicative of the growing interest in safety existing in industry today.

The paper mills and paper goods manufacturing plants were classified into groups according to the number of man-hours worked during the contest period. The final standings of the contestants were determined by the number of lost-time accidents figured against the total number of hours put in by all employees. Workers in 62 paper mills and paper goods manufacturing plants put in 10,651,557 man-hours during the seven month period. Two hundred and eighty-seven accidents occurred giving the industry a final frequency of 27 accidents per million man-hours worked.

Plaques and certificates were presented to the winners as mementos of their standing. Both employers and employees of the concerns are enthusiastic over their safety records for this period and their achievement in the contest.

◆ AT THE ANNUAL meeting of The Sandy Hill Iron & Brass Works, held May 1st, at the office of the Corporation, 27 Allen Street, Hudson Falls, New York, A. J. Kennedy was re-elected president, Dr Richard C. Tefft, Jr., of Boston, vice president, and W. J. Elliot Simpson, secretary and treasurer. Harry L. Broughton and Chas. W. Kellogg, together with the above named officers, were named as directors for the ensuing year.

◆ Grellet Collins Made Chairman of Board

Dill & Collins, Inc., Philadelphia, Pa., announces that Grellet Collins, for many years president of the company, has been elected chairman of the board of directors. This action is in conformity with the company's policy of having active direction of affairs in the hands of younger men, while retaining the accumulated experience and wisdom of its older executives in an advisory capacity.

H. P. Carruth succeeds Mr. Collins as president. W. R. Maull continues as vice president. Sydney Ferguson was re-elected treasurer, and C. E. Barnard, secretary and assistant treasurer. M. G. Benson has been appointed general manager, and W. R. Ingersoll continues as sales manager.

◆ George H. Mead Becomes Chairman of Industrial Advisory Board

NRA's Industrial Advisory Board announced on May 1, the election of George H. Mead, nationally known paper manufacturer, as its chairman to succeed Henry S. Dennison whose term has expired. Mr. Mead, who joined the Board on March 1, is president of the Mead Paper Corporation.

Simultaneously announcement was made of the appointment of Colonel Arthur W. Little, chairman of J. J. Little & Ives Company, New York, to fill one of the vacancies caused by the retirement of Mr. Dennison and of H. P. Kendall, President of Kendall Co., of Boston and Thomas J. Watson, President of International Business Machine Corporation, New York, whose terms likewise expired May 1.

◆ THE BUREAU OF Foreign and Domestic Commerce reports that a new company for the manufacture of alpha cellulose has been organized by Japanese interests. The new concern has an authorized capital of 15,000,000 yen, 3,750,000 yen of which have been paid in. The company has secured a concession from the Manchurian Government of a timber stand containing about 1,200,000,000 feet, board measure, of wood suitable for making pulp. The first mill will be located near the Manchurian-Korean border on the River Tumen. The concern is also reported to have received another concession from the Manchurian Government containing about 26,400,000,000 feet of softwood timber in the vicinity of the River Sungari, where a second mill may be built. Each of the mills to be erected by the company will have an initial productive capacity of 20,000 tons of sulphite pulp per year suitable for the manufacture of rayon. Supplies of this grade of pulp are now imported from the United States, Canada, and the Scandinavian countries.

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Bars, Shapes	Rivets, Bolts	Concrete Reinforcing	Brass and Copper
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Rails, Plates	Chain	Solder	Floor Plates
Sheets—Steel, Copper Bearing and Armco Ingot Iron—Plain, Galv. and Corrugated	Turnbuckles	Refined Iron	Safety Treads
	Shafting	Stainless Steel	Small Tools
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	Boiler Tubes	Ryertex Bearings	
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They are water lubricated « » Consume less power « » Help produce cleaner stock « » Quickly replaced « » Will run submerged in pulp stock « » Last longer « » Practically unaffected by acid solution. *Write for Bulletin 42*

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1864 *The Qualifications of* 1934

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Satisfying performance
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Order today and
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TECHNICAL DEVELOPMENTS

The following abstracts are of the latest developments found in the foreign press and in the patent offices. Photostats and translations of complete articles and patents can be obtained at cost price.

IN THE PAPER INDUSTRY ■ DOMESTIC AND FOREIGN

◆ German Standards in Pulp Testing

In a detailed and very important address before the main convention of the pulp and paper chemists and engineers held in Berlin on December 8th, 1933, the author gives the report of his committee on disintegration, beating, refining, sheet formation and drying of pulp. As yet, the initial mechanical disintegration has not been standardized. The non-beating (initial) strength tests recommended by British Paper Chemists were considered unsatisfactory. While the Lampén ball mill is useful, its operation is not simple enough, and the results cannot be properly correlated with actual beating practice. The Jackro Mill, developed at Darmstadt by Jonas and Kross, is strongly advocated as a means of hydration and the detailed data indicate that with various types of pulp (hard unbleached sulphite, bleached sulphite, and unbleached soda pulps) unusually consistent results may be obtained not only in the same laboratory at various times, but in different laboratories as well. These results, giving the time of refining against tearing strength and degree of hydration are tabulated and graphically reproduced. Apparently the most satisfactory sheet is obtained by using the new RAPID KOETHEN sheet machine, which involves both sheet-former and drier. The open, cylindrical sheet machine is shown in Fig. 1. It consists of an upper filling chamber, an intermediate screen-suction chamber for water removal and a lower water-storage chamber. A motor-driven pump supplies air and water, which are distributed through suitable pipe-lines, and a series of cocks and valves. The sheet-drier is shown in Fig. 2. Actually it is a press and drier combined in a single unit. The

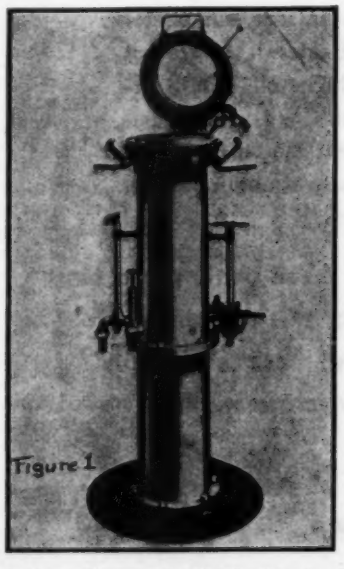
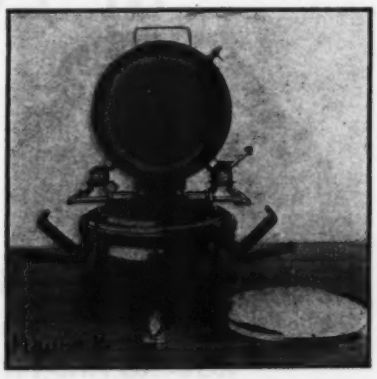


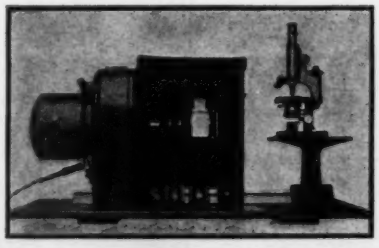
Figure 1



upper lid is steam heated. The middle portion is a screen on which rests the sheet forming screen. The drier has a vacuum attachment, thus permitting the sheet to be dried by steam and under diminished pressure. A detailed procedure is given for the operation of the Rapid Koethen equipment, which evidently occupies little space. Tabulated results show the differences in strength tests obtained with the Rapid Koethen method on the one hand and the Jackro sheet-former (not to be confused with the Jackro Mill) on the other. The latter gives strength tests quite similar to the former, but only with those pulps that have been hydrated during fairly extensive time periods; the time of hydration naturally depending on the type of pulp used. However, if only slightly hydrated stock is used, the Jackro sheet machine yields much weaker sheets. Whereas, in the older Paper Commission's method of sheet formation the pressure applied reached 15 kg./cm^2., the Rapid Koethen method requires only 1 kg./cm^2., but the strength tests on the finished sheets show no appreciable differences in either case. Bruno von Possanner; Papier-Fabr. 32, No. 4, 37-45 (1934).

◆ Fibers Under the Fluorescence Miscroscope

Following a short review of the literature on the fluorescent properties of papermaking fibers, with special reference to the work of Noss and Sadler (Papier-Fabr. 30, No. 36,541 [1932] and 31, No. 31,413 [1933]), the authors describe their own equipment and technique. The Zeiss luminescence microscope is shown in the figure. A self-regulating arc lamp sends its light through a quartz converging lens, and through an iris-diaphragm to the ultraviolet filter which consists of a cell (of U. V. glass) containing copper sulphate solution that filters out the red heat radiations. Thence the light passes through two or three black glass panes, which serves to filter out the remaining visible light. The residual waves are now passed through a quartz converging lens, a quartz prism and a quartz microscope condenser to the object in which the fluorescence is to be stimulated. The fibers are placed on small quartz slides, and the object under examination causes invisible light to become visible; i. e. fluorescence results. An ordinary microscope may be used for the subsequent study. So that ultraviolet rays shall not reach the observer's eyes, cover glasses of so-called Euphoglass may be used. These absorb ultraviolet and transmit ordinary light. Since, however, these glasses seem to alter the colors somewhat, a better technique appears to be to use ordinary cover glasses and to observe the fibers in a darkened field, by adding a special shutter to the condenser. The primary fluorescence of unstained fibers did not serve adequately to differentiate them, except in the case of unbleached sulphite, which, in contrast to all the others shows a deep blue-violet fluorescence. The so-called secondary fluorescence is brought about by staining with dyes, especially basic dyes, which are more effective in this



respect than are acid dyes. Comparatively few direct substantive dyes are satisfactory. The dye concentration is about 0.05 per cent and the time of fiber immersion is 2 minutes as suggested by Noll and Sadler. The authors have given extensive tabulated data, especially on the secondary fluorescence caused by the action of Flavophosphin 4G on the following papermaking fibers: unbleached and bleached sulphite, unbleached and bleached soda, birch pulp, chemical and mechanical aspen pulps, beech, chestnut and eucalyptus pulps, straw pulp, esparto pulp, bamboo pulp, bagasse, cornstalk and jute pulps, original jute fiber (the Asiatic fibers),

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gampi, mitsumata and kodzu; peat (prepared according to Zchörner) long-fibered cotton, linters, flax, ramie, mechanical pulps from spruce and Scots pine, as well as brown pulp from the latter. Although often sharp differences are not evident, the method is very useful for a limited number of mixtures. For example, if unbleached sulphite is absent, as shown by primary fluorescence, bleached sulphite may be differentiated and estimated. On the other hand, staining with Rhodamin 6 GD extra does not lead to a differentiation of bleached sulphite and soda pulps from softwoods, a finding evidently at variance with that of Noss and Sadler. In a mixture of coniferous wood pulps that is definitely free from unbleached sulphite, Sulphorhodamin G permits the detection of unbleached soda pulp in the presence of bleached soda or sulphate pulps. The former shows a wine-red fluorescence, while the two latter appear greenish-yellow. While unbleached and bleached sulphite and bleached soda all show a wine red color with the substantive Geranin G, unbleached soda gives a range from pale pink to a weak green fluorescence, depending upon the degree of previous delignification, and may be identified in this way. When stained with Rhodamin 6 GD extra, Gampi and Mitsumata fibers cannot be differentiated. Both fluoresce orange-yellow. However, they show different fluorescent properties from that of Kodzu, the yellowish green color of which may be readily recognized, and the percentage of which may be estimated in admixture with the other two. This finding is of some interest because of the morphological difficulties in recognition. Adansonia fibers when stained with Brilliant Dianil Green G show a uniform bright blue fluorescence. Under similar conditions Manila hemp and jute show both a deep blue together with a yellowish-green coloration. Here again the three fibers are difficult to separate morphologically, and therefore if a sample shows a uniform blue fluorescence, the microscopist can definitely exclude Manila hemp and jute. An especially interesting difference between spring and summerwood (in the pulps themselves) may be made by means of Brilliant Dianil Green G. Fibers from summerwood show a sky blue fluorescence. Those from springwood appear yellowish-green. Here the digestion and bleach, or the lack of bleaching, seem to have no effect on the color differences. Other examples are also cited. B. Schulze and E. Göthel. Papier-Fabr. 32, No. 10, 110-14 (1934).

◆ Improvement in Paper Machine

The invention seeks to break up the aqueous vapor layer that surfaces the paper sheet as it makes contact with the drying cylinders by bringing air into direct contact with the sheet, thus rendering drying more effective and increasing the output of the machine, which may then be run at greater speed. The usual cylinder or drum (a) (Fig. 1), mounted on the framework (b) is above the press roll (c). At either extremity of the drum is a semicircular chamber (d), larger at one end than at the other and these chambers are joined to each other by the tubes (e), which

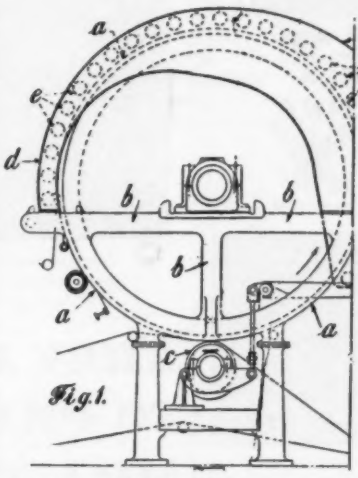

Fig. 1.

are symmetrically spaced and which pass above the surface of the drum. Each tube (e) has a slot (f) (Fig. 2) or is supplied with perforations, and

Fig. 2

stretches out over the entire width of the sheet. In the illustration the machine has 28 tubes per drum (3.6 meters in diameter). A fan or blower (g)

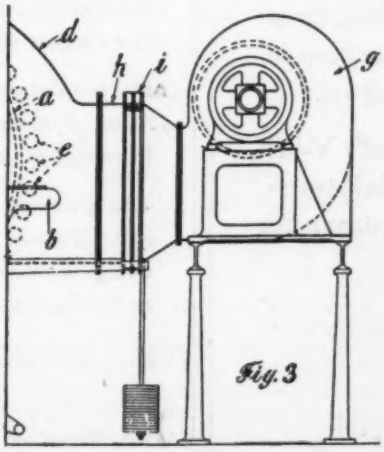

Fig. 3

(Fig. 3) supplies the air, which may be heated if necessary by a battery of steam tubes (i) and which passes through the chamber (h) into (d). From these chambers (d) at the two ends air is supplied to pipes (e). The amount of preheating is contingent on the prevailing humidity conditions and on the temperature. The air escapes from the slits or perforations in (e) in the form of strong jets and the moisture escapes between tubes (e) as shown in Fig. 3. Samuel Milne; England. French Patent No. 756,809.

◆ Ink Components and Penetration

A simple attempt is made to evaluate and to standardize various inks in terms of their penetration into paper. Experiments in which the ink marks were made on paper surfaces were sufficient to show variations in the inks under examination. The total acidity and the intensity of acidity of the inks as well as their total organic matter were found. The charges on the ink dyestuffs and their solvents were determined by dropping the ink on filter paper (but the further technique and the interpretation of data are not given—Translator). The electrical charge of the dye and the tannin present appear important, and the acidity is a determining factor in the ease of writing on paper. For example, paper is more permeable to acidified ink than to one that has been rendered alkaline. The favorable action of iron salts may be vitiated by too much acid. It was also shown that despite a suitable iron and acid balance in the ink, a negatively charged dye or tannin may increase the penetration of the ink into the paper. Natural inks, and positively charged dyes in the inks appear to be the most effective. The other components of ink (i. e. those not cited above) are of small moment in the question of penetration. In practical tests, ink marks must be made with acid-proof pens (such as those with platinum points) so that no iron dissolves in the ink under examination. The author also gives a series of formulas for ink manufacture. Sotowa. Arbeiten des Allrussischen Inst. Papier-u. Zellstoffindustrie, No. 3,11 (1932); through Papier-Fabr. 32, No. 9,103 (1934).

◆ Furfural Number in Pulps

A comparative study was made of the thiobarbituric acid method of Dox and Plaisance and the coloroimetric method of Suminokura and Nakahara (Trans. Tottori Agric. Sci. 1928, Vol. 1, 148) for determining furfural in the distillate obtained on heating pulp with hydrochloric acid. In solutions that are low in furfural, thiobarbituric acid reacts more readily with hydroxymethylfurfural (a regular contaminant) than does barbituric acid. On the other hand, Suminokura and Nakahara's method, which depends on the formation of a very deep cherry red color by the interaction of metaxylidene in acetic acid and furfural, apparently does not affect hydroxymethylfurfural, in dilute solution. Since the method of the Japanese investigators is also rapid, it is recommended by the authors. Helge Aspelund and F. W. Klingstedt, Pappers Trävarutid Finland, 15,682 (1933); through Papier-Fabr. 32, No. 3, 34 (1934).

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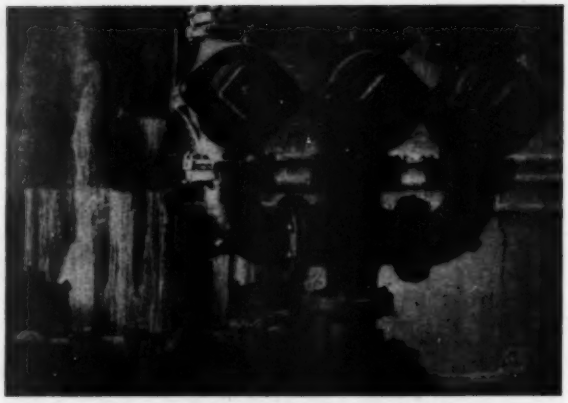

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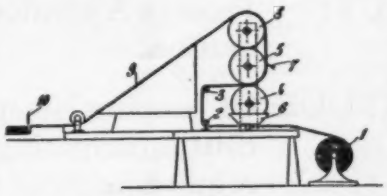
◆ Specific Gravity of Pulpwoods

The volume of 100 samples of German spruce wood were determined by actual measurement, directly after the drying of discs cut from trees of uniform growth, and also by the Horst Niethammer submersion method (Papier-Fabr. 29, 557 (1933)). The weight of these same bone-dry samples was then determined, and the specific gravity computed. The determinations are limited to woods used in an individual German mill. The specific gravity of the woods ranged from 0.331 to 0.549, with a mean value of 0.441. This compares very favorably with the routine specific gravity determinations obtained by the firm of Kübler and Niethammer during 1931-1933 inclusive. Their mean was 0.447. The chipped wood was placed, in each of the 100 cases, in a specially constructed sieve-like basket that was hung within the commercial digester and subjected to the usual cooking conditions prevailing within the mill. After the cook, the container was withdrawn, the pulp carefully washed, disintegrated and dried. The pulp yields (in the 100 cases cited) averaged 50.9 per cent. One solid cubic meter of spruce (Festmeter) gave 225 kg. pulp. The individual variations in pulp yields, which ranged from 49.52 per cent was evidently not due to fluctuations in specific gravity. The mean yield from woods below 0.4 in sp. gr. was 50.5 per cent. From woods ranging between 0.4 and 0.5 in sp. gr. the average yield was 50.8 per cent. Woods of sp. gr. above 0.5 gave pulp yields averaging 50.9 per cent. In all cases the experimental pulp samples, which were medium-soft, with a Sieber Number between 35 and 40, were practically free from slivers, knots, etc. The author also discusses commercial cooking operations, which, if due consideration is given to the usual losses (sawdust, shrinkage, etc.), give much the same yields as did the experimental cooks. The results are tabulated and the methods of converting the yields from a solid cubic meter to those of a stacked meter (Raummeter) discussed. Rudolf Sieber. Papier-Fabr. 32, No. 9,104 (1934).

◆ Sensitizing Valuable Papers

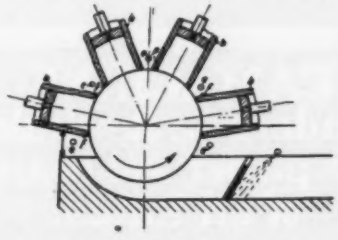
The object is to surface the sheet with an extremely thin sensitized coating, the nature of which is not cited, without allowing the paper to become in any way impregnated with this material. In this way any subsequent superficial scratching or washing immediately destroys said coating, and forgery becomes difficult or impossible. The original paper is led from the winder (1) (as illustrated) over the guide rolls (2) and (3) between the two principal rollers (4) and (5). Roll (4) is partially immersed in the container (6) in which is stored the sensitizing material dissolved in an aqueous agglutinant, and heated to about 40 deg. C. Roll (5) is heated to approximately 100 deg. C. in order to insure very rapid drying of the sensitizing layer, and is supplied with a scraper (7), so arranged that the excess of coating material may be rapidly returned to (6). The resultant surface film is thus maintained at the desired thinness. The pressure of the scraper (7) also aids in the rate of drying the paper. The speeds of rolls (4) and (5) are identical, and (4) does not place the paper under any pressure, serving simply as a coating drum. A suitable device keeps the sheet tangential to (4), and also from slipping on the cylinder. From (5) the sheet passes over the top of the supplementary drying cylinder



(8), and thence over the refrigerating device (9) through which cold water may circulate, to the mechanical cutter (10) that not only serves to cut the sheet into leaves, but which is also equipped for numbering each sheet. A second claim describes a similar set-up, which contains a series of mechanisms for numbering, perforating, stamping, etc., installed in series prior to the cutting device (10). This manufacturing technique is claimed to be valuable in the coating of paper to be used in cheques, titles and various securities. Armande Deplanche; French Patent No. 757,540.

◆ Temperature Control in Pulp Grinders

The lowest parts of the wall of the pockets (b) are fitted with 2 or more thermal elements (F) which serve to record temperatures over the entire surface of the pulpstone. In the Figure, (e) indicates the arrangement of pipes carrying water. The temperature of



the slush is recorded in this way. In a second patent claim the water pipes (e) are correlated with the thermal elements (F) so that the water flow may be controlled in accordance with local temperatures. W. Drechsel, Muldenstein, near Bitterfeld. German Patent No. 592,107; Kl. 55a.

◆ Oilproof Insulating Material

The material, made of various plies or layers, has properties resembling those of a hard paper, and may be moulded like the latter. Besides this it also has the properties of a cardboard—i. e., it shows a high absorptive capacity for oil. The entire surface of the insulating material is not coated with a layer of resin, and the binding material between the various layers of insulating sheets is only placed at a sufficient number of points to insure ample cohesion, as well as far-reaching absorptive capacity for transformer oils and similar liquids. Micafil, A. G. Werke für Elektro-Insulation, Zürich, Alstetten. Austrian Patent No. 135,348.

◆ Pulp Testing in Russia

An attempt is made to standardize the methods used in testing pulp in the Russian paper industry. Special attention is given to viscosity measurements, which are carried out under closely standardized conditions, largely with a view towards eliminating the influence of air. Five tenths gram of bone-dry pulp is allowed to swell in a 2 per cent ammonium hydroxide solution, filtered by suction and then peptized under agitation, within 30 seconds, by means of 50 cc. of Schweitzers reagent. The reaction vessel which appears to be connected through its glass stopper with a suitable viscosimeter is then heated for exactly 10 minutes at 20 deg. C. and the viscosity measured without delay. The time periods and conditions given must be strictly adhered to, since the viscosity continues to drop because of contact with the air. The total time of measurement requires not over 40 minutes, and reproducible results are claimed. It serves as a control method in pulpmaking practice. The author has also examined a variety of methods for determining the water content of pulp, paper and of wood. Drying in a stream of air or distillation with toluol are recommended. The percentage of resin in wood was best determined by an extraction method. The degree of relignification (or pulping) was best determined by the Roe method. The permanganate method of Joachim (Papier-Fabr. 29,317 (1931)) was found preferable to that of Björkmann. A new method is claimed for lignin determination (although in principle it essentially resembles that of Noll, Bolz and Fiedler, and was found unsatisfactory in the case of certain pulps by Lewis, Koonce and Young, Cf., THE PAPER INDUSTRY, Vol. 15, No. 9, 509 (December, 1933) — Translator). One to 3 grams of pulp are disintegrated in the presence of alcohol, filtered through a fritted glass crucible, and treated with 6 cc. of dimethylaniline and 30 cc. of 78 per cent sulphuric acid. The rapid saccharification is followed by treatment with 200 cc. of boiling water, the mixture is allowed to digest on a water bath for one half hour, and the lignin is filtered through balanced filter papers. These are dried together with the lignin at 105 deg. C., and in weighing, the non-lignin-containing filter is used as a counterpoise. F. Hütter; Arbeiten der allrussischen Institute für Papier u Zellstoffindustrie, No. 4, 50 (1932); through Papier-Fabr. 32, No. 9,104 (1934).

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The COMMERCIAL OUTLOOK

New York, May 1, 1934.

THE TONE of the paper market is growing steadier as operations under the code become more complete. Not in a long while have prices of the various grades of paper exhibited such stability as is now in evidence. Moreover, it would seem the market's firmness is acting as a stimulus to demand; at any rate, the call for supplies from consuming and distributing quarters is gradually though consistently expanding. In short, the market is becoming livelier.

On all sides are positive signs that paper users and converters are purchasing reservedly; that seldom are they absorbing other than required supplies. Contracts are being placed for forward deliveries, of course, but even in such instances commitments are confined almost entirely to known needs. Spot buying, too, is limited to definite requirements. Consequently, demand is of very healthy character, and the gradual increase in market activity is based on rising consumption of paper and a resultant expansion of buyers' needs.

Reports from numerous corners of the industry tell of production gains and of a steady increase in activity among mills. Figures covering the past several months divulge some production increases little short of surprising. This means that paper manufacturers are receiving more business, and are extending their output to take care of the larger volume of orders coming in. It is estimated generally that the average volume of business in paper is now running fully 40 to 50 per cent above that of the same time a year ago, and current production is figured to be larger—from an aggregate standpoint—than at any time in two years or longer.

The outlook for the industry is regarded as bright. General business has shown consistent improvement since the first of the present year and as yet there is no slowing down tendency observable. The retail movement of merchandise is still expanding; more favorable weather conditions in most sections of the country during the last several weeks have resulted in further gains in the retail turnover, and merchants confidently expect a continuance of the increase until the summer sets in. There has been some decrease in activity in wholesale lines in recent weeks, but this was rather to be expected in view of the broad operations of manufacturers and wholesale distributors earlier in the year, and is regarded as nothing more than a natural development. Also, there has been a downward trend in wholesale commodity prices, and an easing tendency in security levels, which many authorities attribute to the unsettling influence of Congressional activities in Washington. The crux of the whole situation would appear to be that merchandise is moving freely through retail channels—over the counters to the actual consumer—and so long as this continues it must be said the general business condition is favorable and healthy.

Opinion within the paper trade is that demand for the industry's product will keep up on at least existing levels, and in all probability register some additional increases, over the next several months or until the customary hot weather lull comes. Prospects for the autumn and the late months of the year are considered extremely bright. "Business in paper, along with other commodities, will be back fully to normal, and probably better than what can be called normal," is the statement of a leading member of the trade, whose expression about sums up the feeling common throughout the industry, among manufacturers and merchants alike.

With March production of newsprint in Canada showing one of the greatest gains in the history of the industry, and output in both the United States and Canada rising 38.1 per cent during the month, production of print paper in March in the two countries exceeded output in any month since 1930. Canadian production was larger than for any March since 1929. With the rate of increase advancing during the first quarter of this year, production for the three months by mills in the United States and Canada was 30.2 per cent ahead of the similar period last year, Canada showing a 40.7 per cent gain, according to figures compiled by the News Print Service Bureau.

Newsprint production in the United States in March amounted to 84,993 net tons, compared with 72,402 tons in the preceding month and 76,566 tons in March a year ago. Canadian output reached 210,129 tons in March, against 174,447 tons in February this year and 137,078 tons in the similar month last year. Production in Newfoundland in March was 24,778 tons, and in Mexico 1,287 tons, giving a total North American output for the month of 321,187 tons, contrasted with 270,358 tons total in the month before, and 236,503 tons in March, 1933. Shipments from mills were 87,987 tons in the United States and 207,197 tons in Canada, compared with 69,251 tons and 169,054 tons, respectively, in the preceding month, a total for both countries of 295,184 tons, against 238,305 tons in February. In short, shipments from mills during March were slightly in excess of the month's production. Stocks of newsprint at U. S. mills at the end of March totaled 18,630 tons, compared with 22,060 tons a month before, and at Canadian mills 42,973 tons, against 40,445 tons, totaling in both countries 61,603 tons, contrasted with 62,505 tons a month earlier.

"The price of newsprint will be higher by the beginning of next year, if not sooner," stated President A. R. Graustein of the International Paper Company, at the annual stockholders' meeting of that company. "We cannot tell how long costs will continue to increase, nor how greatly. We do know, though, that in a time like this, when costs are increasing, it will be necessary for us to get higher prices for our product," Mr. Graustein added.

Paperboard production in the United States in February totaled 224,344 tons, compared with 230,311 tons in the month before and 205,871 tons in the corresponding 1933 month, a total for the first two months of the current year of 454,655 tons, against 411,197 tons in the same period last year, according to the monthly summary of the Census Bureau. Board mills produced at 62.8 per cent of their rated capacity during February, contrasted with 57.3 per cent in January this year and 58.8 per cent in February last year. Shipments of board from mills amounted to 189,097 tons in February, against 187,557 tons in the month preceding, and stocks on hand at the end of February aggregated 78,925 tons, compared with 75,005 tons a month before. New orders received by manufacturers called for 235,346 tons in February, contrasted with 218,169 tons in January, and unfilled orders at the end of February were for 75,143 tons, against 63,328 tons a month earlier.

◆ ◆

◆ Gair Company Canada Ltd.

Gair Company Canada Limited, a newly organized subsidiary of Robert Gair Company, Inc., has taken over the operation of the five paper mills of Canadian Paperboard, Ltd., at Toronto, Montreal, Frankford and Campbellford.

Four of the mills manufacture paperboard; a second mill at Frankford produces groundwood pulp.

Geo. W. Brown, president and general manager of Firstbook Boxes Limited, another Gair subsidiary, will be vice president and general manager of Gair Company Canada Limited; H. J. Daubney, formerly general sales manager in the United States for Price Bros. of Canada, will be general manager in charge of the Canadian mills; Chas. E. Whitten, formerly secretary-treasurer of Canadian Paperboard, Ltd., will serve as secretary-treasurer of Gair Company Canada Limited.

Robert Gair Company, Inc. now has 17 plants manufacturing paperboard and fabricated paperboard products.

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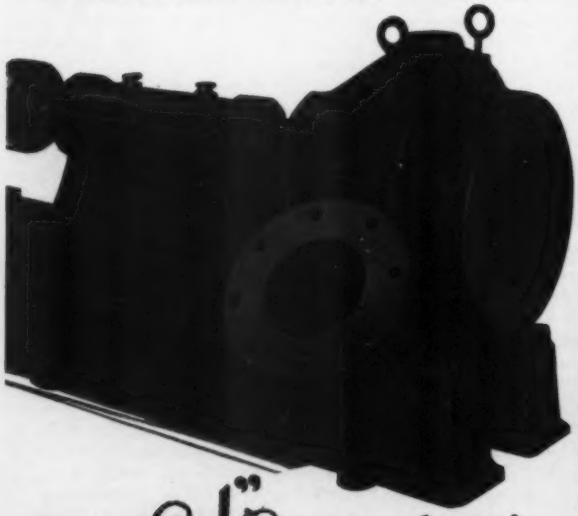

"Buffalo" non-clogging paper stock pumps

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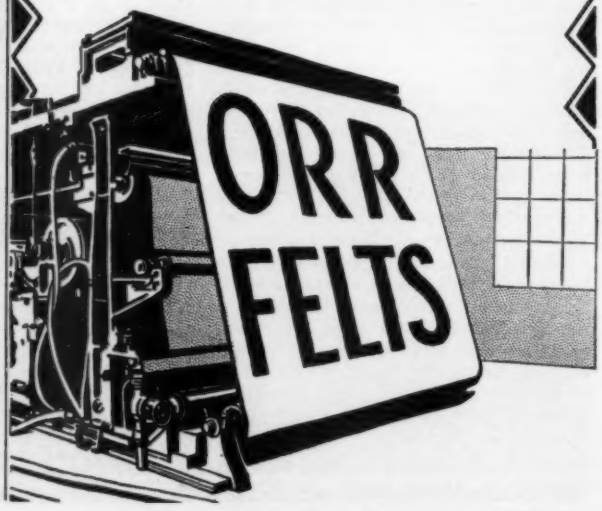

Domestic RAW MATERIALS

◆ Papermaking Rags

With the exception of wood pulp, which is enjoying fairly active demand, the market for nearly all other raw material items entering the paper mill is comparatively quiet. There is business transpiring, of course, but it is chiefly of routine character and volume, as it would appear paper manufacturers are restricting buying almost exclusively to supplies immediately required.

The papermaking rag situation seems favorable to consumers, insofar as the market shapes up at present. Demand evidently is falling short of the available supply of most grades, and under these circumstances, buyers likely are succeeding in getting the supplies desired at the prices bid, which in some cases are slightly under quoted market levels. On the other hand, it is the contention of dealers that aggregate amounts of rags in the trade are far under normal tonnage; that spring collections this year have not come up to usual quantities; that not only are importations into the United States far below normal but considerable quantities of rags suitable for paper mills are being exported from this country to Europe, and that any appreciable expansion of consumer buying would quickly clean up existing stocks and in all probability lead to price advances.

Quoted prices have developed little definite change, since dealers are doing what they can to maintain market levels and are not offering to sell at reduced rates, other than perhaps in exceptional instances. Moreover, dealers are stressing the increased costs of rags under code operation and insist they can ill afford to accept lower prices; at the same time feeling that market values are destined to rise as higher wages and shorter hours under the code become more of an influential factor. New cuttings of most grades therefore are quoted steadily. No. 1 new white shirt cuttings are held at around 6.75 cents and in frequent cases at 7 cents a pound f. o. b. shipping points, new soft unbleached muslins at 7.25 to 7.50 cents, fancy shirt cuttings at 2.50 cents, light silesias at 4.50 cents, blue overall cuttings at 4.25 cents, washables at 2 cents, bleached canton flannels at 5.50 cents, and khaki cuttings at 4 cents. Writing paper mills are absorbing these rags in rather spasmodic fashion, evidently waiting for definite requirements to develop before entering the market.

Roofing rags are registering a little better market activity. Felt mills have been more generally in evidence as buyers and have purchased most of the roofing rags on the market, paying firm prices. Prices of domestics are still well below parity with imported material, so that the bulk of buying has been of domestic rags. No. 1 roofing stock is bringing around 1.15 cents per pound at dealers' shipping points, No. 2 stock 85 and 90 cents per hundred pounds, and No. 3 and No. 4 roofing 75 to 80 cents. Mills are buying in some sections of the country at a little under these prices, it is reported. Old No. 1 repacked whites are quoted at 3 cents a pound, and repacked thirds and blues at around 1.40 cents at shipping points. A grade of old rags strong in price and in small supply is old black cotton stockings, which are said to be selling at 4.25 cents a pound, and higher.

◆ Old Paper

Paper board mills are purchasing waste paper in restricted tonnage, and there is every indication that a surplus of supply of the bulky grades exists, with the inevitable result market prices are none too steady. Quotational changes recently have been, practically without exception, in a downward direction. Furthermore, it would appear that additional reductions in price are likely unless consuming demand expands to take up some of the supply slack. No. 1 mixed paper is selling in the East at 25 cents per hundred pounds f. o. b. shipping points, and in the West at 40 cents. Old folded newspapers are 35 cents a hundred in the East and 60 cents in the West, at dealers' points. Book stock has declined to where No. 1 heavy flat magazines are being bought by mills at 75 cents per hundred pounds f. o. b. shipping points; old No. 1 kraft paper is available at 1.10 cents a pound, white news blanks at 1.20 cents, old corrugated boxes at 45 cents a hundred pounds, and ordinary colored ledgers and writings at 1.10 cents per pound. Shavings are quoted relatively steady on a price range of 2.25 to 2.50 cents a pound, depending on the packing, for No. 1 hard white shavings, and 1.85 to 2.10 cents for No. 1 soft white shavings, with special qualities costing somewhat in excess of these prices.

◆ Mechanical Pulp

Groundwood is characterized by a fairly active demand and steadiness in price. Consumers are taking supplies readily, both on contract and in spot purchases; reports say that producing mills are well sold up for some time ahead, are not over-eager for orders and are naming firm quotations to customers. Canadian groundwood is quoted around $22 per ton f. o. b. pulp mills across the border or the equivalent of $29 to $33 delivered consuming points in northern United States. Domestic groundwood, which is offered sparsely, is priced at around $26 a ton at producing centers.

◆ Chemical Pulp

The outstanding feature in the chemical wood pulp situation seems to be the sold up position of most producing mills and their apparent reluctance to enter additional sales commitments over the next few months. Pulp consumers have bought freely in recent months and have contracted for the great bulk of supply to become available for quite a while; producers evidently feel that any revisions in prices over the balance of the year will be upward, and therefore are not keen about effecting further sales at the market levels prevailing. This does not mean that pulp is not to be had in the market, but the condition is largely a sellers' situation.

Bleached sulphite of prime quality is quoted at established prices ranging upwards from 2.75 cents a pound ex dock Atlantic seaboard basis, with some grades priced at 2.90 cents, 3 cents and higher. Unbleached sulphite is 2.10 to 2.20 cents for the ordinary prime qualities, and 2.25 and 2.30 cents for easy bleaching sulphite. There is talk of an impending advance in the price of bleached soda pulp, now quoted at 2.50 cents delivered book paper mills, the rise to amount to $5 a ton, it is stated. Domestic kraft pulps are steady quotably on a spread of 1.75 to 2 cents per pound for most grades f. o. b. producing mills.

◆ Chemicals

Quotations on papermaking chemicals are firm of tone, and generally maintained. The 76 per cent solid caustic soda is quoted at 2.60 cents a pound on contracts f. o. b. works, and the flake product at 3 cents. Bleaching powder is 1.90 cents a pound upwards at works; soda ash 1.25 to 1.30 cents for the 58 per cent light product in bags or 1.05 cents in bulk; chlorine 1.85 to 2.25 cents at works on contract, and casein at 12.50 to 13.50 cents a pound for domestic and 14.50 to 15 cents for imported casein, depending on the grind.

◆ Rope and Bagging

Paper manufacturers are making occasional purchases of old bagging, though the market at present is quieter than recently. A fairly bullish supply condition prevails, and lends support to ruling values. No. 1 scrap bagging is reported bringing around 1.25 cents a pound at shipping points; prices vary to some extent depending on the source and quality of the material concerned. Roofing bagging is selling at 70 and 75 cents a hundred pounds, and prices of foreign bagging—both No. 1 scrap and roofing—are a little above those mentioned on domestic packing. Old rope is in slow call. Nominal prices are 2.50 cents a pound f. o. b. dealers' points on No. 1 domestic old manila, and in the vicinity of 2.25 cents ex dock New York for foreign manila rope, and mills apparently are procuring all the supply wanted at these price levels and lower.

◆ Pulpwood

Pulpwood is reported moving freely to pulp plants, though mainly against contracts. The market is possessed of a steady undertone, and quoted prices are fully maintained and pointed upward.

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Import and Export MARKETS

IMPORTS

◆ Wood Pulp

The market for foreign wood pulp is firm of tone, due to both a consistently good demand of fairly broad dimensions from consumers and a rather strong supply situation at producing sources abroad. Paper and board manufacturers in the United States are buying pulp freely. Evidently they view prevailing prices as reasonable, everything taken into consideration, nor do they apparently expect market levels to be any lower for some time to come, and consequently are covering requirements without hesitation, and for a considerable period ahead. Reports have told of sizable orders being placed in recent weeks and many of the commitments have been for shipments from primary sources in Europe a far time hence, some consumers covering a part of their prospective needs up to the end of 1935.

Nearly all advices from abroad put a good deal of emphasis on the well sold up position of pulp mills in Scandinavia and other European countries. This does not mean there is no pulp available for current shipment or that orders cannot be readily placed for forward shipments, but it is said to be a fact producers in Europe are better sold than in a long while and that some have virtually no tonnage to dispose of over the next few months.

Opinion within the pulp trade is agreed that price changes in chemical pulp over the balance of this year will likely be in an upward course. This will depend obviously on market developments, as well as exchange movements and other influential factors. The fact remains that world consumption of wood pulp is running well in excess of that a year ago; that indications point to a further increase in consumption, and that producers in Europe are adhering to a program of production curtailment, more particularly as regards sulphite. Therefore, most members of the trade are of the belief the law of supply and demand will operate to raise market prices at least moderately.

Demand from American paper mills is reported mainly for unbleached sulphite and kraft pulps. Bleached sulphite is relatively quiet, and the reason given for this is that prices of such pulp are regarded by consumers as proportionately high under the system of established market levels in comparison with ruling prices on unbleached sulphite, with the result a good many paper mills are said to be bleaching their own sulphite—purchasing strong unbleached sulphite and converting it into bleached pulp, and thus economizing on costs.

Bleached sulphite of imported prime quality is quoted at 2.75 cents per pound upwards ex dock American Atlantic seaboard, with extra grades 2.90 cents and higher. Strong prime unbleached sulphite is 2.10, 2.15 and 2.20 cents a pound ex dock basis, depending on grade, and it is said not a great deal of the 2.10 cents class is now available in the market, most producers being well sold up on this pulp. Easy bleaching sulphites are quoted at 2.25 and 2.30 cents, while prime Scandinavian unbleached kraft is very firmly priced at 1.85 cents to slightly higher, according to quality and shipment. Scandinavian groundwood is on a quotable level of around $28 per ton for dry weight ex dock American Atlantic ports. Groundwood mills abroad also are well sold up, especially for the next couple of months, and offerings are sparse.

Imports of pulp into the United States in February showed a small gain over the preceding month, totaling 128,708 long tons of chemical grades of a declared value of $5,003,543, compared with 124,911 tons of a value of $4,697,895 in January this year, and 87,891 tons of a value of $3,091,882 in February last year. The February receipts brought the total during the first two months of this year up to 253,619 long tons, valued at $9,701,438, contrasted with 211,972 tons of a value of $7,198,940 in the similar two months of 1933. Groundwood imports in February were 10,186 long tons, valued at $187,360, against 13,137 tons of a value of $215,013 in the preceding month, and making a total for the first two months of the current year of 23,323 tons of a value of $402,373, against 12,325 tons of a value of $221,087 in the corresponding period last year.

◆ Paper

Imports of paper into the United States in February were smaller in point of total value than in the month preceding, according to figures issued by the U. S. Department of Commerce. The February imports reached a value of $5,129,203, compared with $6,621,380 in January this year and $4,297,368 in February last year. Two months' imports this year amounted in value to $11,750,583, against $10,223,050 in the similar time a year ago. Newsprint comprised the major portion of imports in February last, amounting to $4,207,286, contrasted with $3,741,379 in the same 1933 month, while cigarette paper was next in importance, February imports reaching a value of $420,648, against $224,860 in the similar month last year.

◆ Paper Stock

Papermaking rag importations into the United States in February, according to official U. S. Department of Commerce figures, were much larger than in the preceding month, amounting to 9,782,416 pounds of a declared value of $104,727, compared with 3,554,071 pounds of a value of $59,651 in the month before and 4,172,238 pounds of a value of $41,606 in February, 1933. Imports during the first two months of this year were 13,336,487 pounds, valued at $164,378, contrasted with 9,658,335 pounds of a value of $87,600 in the same time last year. Imports of miscellaneous paper stock, including old rope, bagging, waste paper, etc., in February amounted to 4,509,740 pounds of a value of $72,583, making a total for the first two months of the current year of 8,947,074 pounds, valued at $147,520, compared with 10,988,212 pounds of a value of $107,642 in the corresponding period of 1933.

EXPORTS

Exports of paper and paper products from the United States during February showed a decrease in total value as compared with shipments in the preceding month but were above the exports in the same month last year, according to U. S. Department of Commerce statistics. The February, 1934, exports reached a total value of $1,362,409, contrasted with $1,500,775 in January this year and $1,051,360 in February a year ago. Exports in the first two months of the current year were valued at $2,863,184, against $2,063,086 in the similar period last year.

Newsprint exports during February amounted to 3,200,999 pounds of a value of $76,602, against 600,499 pounds of a value of $15,432 in the same 1933 month. Uncoated book paper shipments were valued at $73,510 in February, compared with $54,633 a year ago, while wrapping paper exports reached a value of $150,791, against $108,232 last year; of writing paper, $85,450, against $61,260; of tissue and crepe paper, $48,856, against $56,270; of toilet paper, $40,833, against $45,780; of blotting paper, $7,669, against $7,653, and of sheathing and building paper, $12,713, against $4,133.

Exports of boxboard were valued at $54,919 in February last, compared with $34,208 in the same month last year, and of other paperboard $67,589, contrasted with $40,806 a year ago. Exports of paper bags in February were valued at $42,003, against $40,943 in the similar 1933 month, while shipments of paper cartons and boxes reached a value of $35,025, compared with $37,348 last year.

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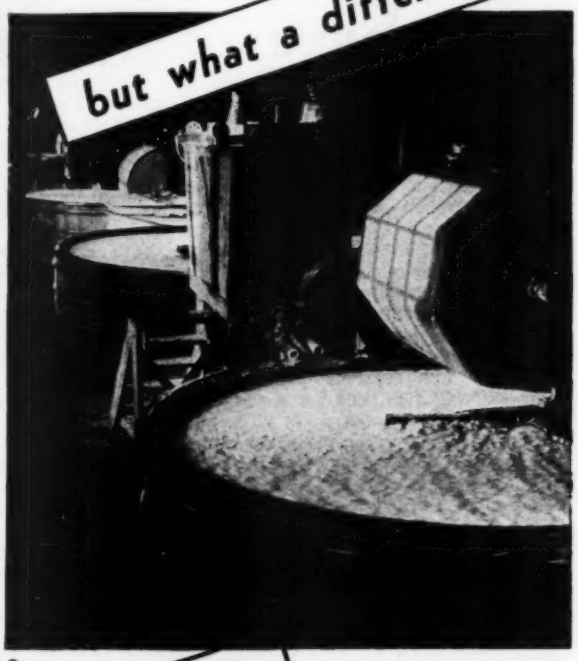

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